THE UNIVERSITY OF ALBERTA

THE IMPACT OF GRAIN PRICE POOLING ON PRODUCER RETURNS AND SYSTEM COSTS

by

DIANE DUNLOP ©

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

IN

AGRICULTURAL ECONOMICS

DEPARTMENT OF RURAL ECONOMY

EDMONTON, ALBERTA

Spring 1989

National Library of Canada
Canadian Theses Service
Ottawa, Canada
K1A 0N4

Bibliothèque nationale du Canada
Service des thèses canadiennes

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur a accordé une licence irrévocable et non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse à la disposition des personnes intéressées.

L'auteur conserve la propriété du droit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

ISBN 0-315-52810-9

Canadä

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR	Diane Dunlop
TITLE OF THESIS	**The Impact of Grain Price Pooling on Producer Returns and System Costs.**

DEGREE FOR WHICH THESIS WAS PRESENTED MASTER OF SCIENCE

YEAR THIS DEGREE GRANTED Spring 1989

Permission is hereby granted to THE UNIVERSITY OF ALBERTA LIBRARY to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

(SIGNED) Diane Dunlop

PERMANENT ADDRESS: 10635 - 47th Ave.
Edmonton
alberta

DATED Feb 10 1989

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled THE IMPACT OF GRAIN PRICE POOLING ON PRODUCER RETURNS AND SYSTEM COSTS submitted by Diane Dunlop in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE in Agricultural Economics.

....

Supervisor

Michele Veeman

A. W. Anderson

....

Date Feb. 10 1989

Dedication

Mr. John Tait and Dr. Mel Lerohl

For their devotion to students

and giving me a direction in my career.

Abstract

This study examines policy issues related to price pooling by the Canadian Wheat Board (C.W.B.) and its regional price effects on production and shipment patterns. Several scenarios were examined in order to determine impacts to production and regional welfare by changing grain prices. In fact the study assesses the effects of the C.W.B. proposal to alter current pooling arrangements, and also examines the effects of new pooling arrangements with rail costs fully reflected in rail rates.

An econometric sub model integrated with a production simulation, and linear transportation sub model was used to assess price pooling. Western Canada is subdivided into seven producing regions. The econometric sub model consists of 21 supply responses. Supply responses for wheat, barley, and canola for each producing area are estimated. Also included in the analysis are two exports ports, West Coast and Thunder Bay, as two separate demand areas. Grain is exchanged between each producing region and the export ports. West Coast (Vancouver and Prince Rupert) capacity constraints are also included in the transportation sub model. To more closely simulate the production and marketing conditions during each simulated crop year, actual shipments through the West Coast were assigned. The methodology used was one of measuring producer and consumer surplus (total welfare) subject to production and demand constraints for shipments between regions.

Overall, Producers tend to shift their plantings away from the more bulky and lower value crop, barley, to the less bulky, higher value crops of wheat and canola under the different scenarios. Marginal changes in transport patterns were found to occur between the various scenarios with actual exports representing West Coast capacity. As the West Coast restriction is relaxed more grain would be transported through Prince Rupert and/or Vancouver ports. Therefore, study findings suggest that pooling results are sensitive to amounts of grain which can be shipped through West Coast ports.

As compared with the remaining price scenarios, larger decreases in producer's welfare were found to occur with uncompensated rail costs fully reflected in producer's freight rates. In Saskatchewan, when producers pay total freight costs, a net loss to the grains and livestock sectors together was estimated. But, in Alberta and Manitoba, the gains from grain consumption outweigh the losses to producers thereby creating a net benefit to the grains and livestock sectors within these provinces.

Acknowledgements

I would like to thank my advisor, Dr. Mel Lerohl, for his patience, guidance, and support throughout my Master's program. After all the hours we spent drawing supply and demand functions, I finally understand the theory, Mel.

Dr. Lerohl also encouraged independent research, which allowed me to search for new approaches in utilizing quantitative economics. His confidence in me and his encouragement to continue my eduction have been appreciated.

I would like to acknowledege the efforts of my committee members: Wayne Anderson , Michele Veeman, and Frank Kehoe. Special thanks to Michele for her extensive editorial comments as well as to Frank Kehoe for his support during the final stages of my research and for sharing his knowledge of the institutional arrangements within the Canadian grains sector. Thanks, Frank, for keeping a Easterner straight on western grains policy! You also reinforced the value of disciplined, objective academic research, "even though this sometimes leads to social unrest."

The financial contribution provided by the Agricultural Research Council of Alberta in support of this study is greatfully acknowledged. Continued funding from the Department of Rural Economy, which permitted additional analysis, is also appreciated.

A special thanks to Bill Phillips for his helpful comments during the development of the study. Bill, I will never forget our brain storming sessions and the long debates over welfare economics. Thanks for keeping a fellow Maritimer in line.

Well, Holly, can you believe it? I'm finally finished! Thanks a lot for the good times, buddy. However it's time to confess to Wendy about the trouble you got me into. (Now you know who to blame, Wendy!)

Clare, I made it before your retirement party! Was there ever any doubt? Jim, thanks for the computer help. At times it made my life a challenge.

Barb and Hildegard, thanks for going out of your way to find those key references. I'm really glad your library doesn't charge fines for long overdue books.

A special appreciation to Frank Novak for motivating me in my thesis writing. Its been a challenge to finish my thesis before you finish yours, Frank. You're going to have to find someone else to pick on now!

Thanks to all fellow graduate students, especially Larry, Ann, Ward, Mike, and Kelly, for helping me adopt an Alberta point of view. To Heath who rehabilitated my Maritime background.

Wayne and Carolyn, your friendship and assistance have been invaluable. Now that I'm finished my thesis, I promise to call at reasonable hours.

Well, Evelyn, it's over. Thanks for your editing tips, good advice, and long telephone conversations. Please DON'T ever read my thesis with a red pen in your hand!

The flexibility and understanding of my co-workers at the Planning Scretariat allowed me to complete the final stages of my thesis. My coffee time debates with Frank, Gorden, Gerry, and Stan helped me to look at my study from a variety of viewpoints.

From the Nova Scotia Agriculture College, I would like to thank John Stackhouse, Dave Arnfast, Gary Grant, and John Brennan for the theoretical training which allowed me to expand into research. Also, my heartfelt appreciation to John Tait, who developed within me the confidence to enter a Master's program. Thanks for your constant support and unrelenting encouragement to continue my studies, John.

A special gratitude to Margo Van de Riet and Sunny Tait for their friendship and advice at various stages of my studies.

Special thanks to my parents for teaching me goal setting and a work ethic. Further, thanks to my family for understanding and supporting me in the decision to continue my education.

Finally, to everyone with whom I've been acquainted during my program, thanks for helping me feel at home in Alberta.

Table of Contents

I. INTRODUCTION 1
  A. Background 1
    1. Importance of the Canadian Grains Sector 1
    2. The Canadian Wheat Board 2
    3. Price Pooling 3
    4. Problem Statement 5
  B. Objectives 7
  C. Hypotheses 7
  D. Sources of Data 7
  E. Plan of Study 8

II. THEORETICAL CONSIDERATIONS 9
  A. Resource Allocation and Trade 10
  B. Spatial Equilibrium and Trade 17

III. MODEL SPECIFICATION 24
  A. Structure of Commodity Models 24
  B. Selected Empirical Methodology 27
    1. Data Selection 29
    2. Geographic Areas 29
    3. Supply Block 32
    4. Wheat Production Response 34
    5. Barley Production Response 37
    6. Canola Production Response 39
    7. Demand Block 40
    8. Production Simulation Sub Model 42
    9. Transportation Sub Model 46
    10. Cost Analysis 49
    11. Welfare Effects 49

IV BASELINE ANALYSIS 51
  A. Production Results Under Current Freight Rates to Producers (1982-1987) 51
  B. Estimated Grain Transportation Patterns (1982-1987) 53
  C. Estimated Grain Transport Costs (1982-1987) 58

V. THE C.W.B. PRICING PROPOSAL (PAY THE RAILWAY) 68
  A. Initial Results Before Adjustments (1982 - 1987) 68
    1. Production Results (1982-1987) 68
    2. Producer Surplus (1982 - 1987) 69
    3. Changes in Consumer Surplus (1982 - 1987) 70
    4. Optimal Grain Shipping Patterns (1982-1987) 72
    5. Shipping Costs (1982-1987) 76
    6. Cost Savings (1982-1987) 86
  B. Policy Adjustments 91
    1. Adjusted Production (1982-1987) 91
    2. Adjusted Producer Surplus (1982 - 1987) 96
    3. Changes to Consumer Surplus (1982 - 1987) 99
    4. Grain Flows (1982-1987) 102
    5. Freight Costs (1982-1987) 106

VI. PAY THE PRODUCER ALTERNATIVE 118
  A. Baseline Analysis 118
    1. Production Responses (1983-1987) 118
    2. Producer Surplus (1983-1987) 119
    3. Changes in Consumer Welfare (1983-1987) 121
    4. Optimal Grain Shipment Patterns (1983-1987) 123
    5. Shipping Costs (1983-1987) 127
    6. Cost Savings (1983-1987) 136
  B. Policy Adjustments 138
    1. Adjusted Production (1983-1987) 138

2. Producer Surplus (1983-1987) 141
3. Change in Consumer Surplus (1983-1987) 142
4. Grain Flows (1983-1987) 145
5. Freight Costs (1983-1987) 147

VII. C.W.B. PROPOSAL UNDER PAY THE PRODUCER ALTERNATIVE 150
A. Initial Results before Adjustments 150
1. Production Responses (1983-1987) 150
2. Producer Surplus (1983-1987) 151
3. Changes in Consumer Surplus (1982-1987) 153
4. Optimal Grain Shipment Patterns (1983-1987) 155
5. Shipping Costs (1983-1987) 157
6. Cost Savings (1983-1987) 163
B. Policy Adjustments 166
1. Adjusted Production (1983-1987) 166
2. Producer Surplus (1983-1987) 169
3. Changes to Consumer Surplus (1983-1987) 171
4. Grain Flows (1983-1987) 173
5. Freight Costs (1983-1987) 175

VIII. MISSISSIPPI RIVER ALTERNATIVE 179
A. Initial Responses to Grain Policies 180
1. Production Responses (1985-1986) 180
2. Optimal Grain Shipment Patterns (1985-1986) 181
3. Shipping Costs (1985-1986) 185
4. Range in Cost Savings after Policy Implementation 189
B. Policy Adjustments (1985-1986) 194
1. Adjusted Production (1985-1986) 194
2. Grain Flows (1985-1986) 199
3. Freight Costs (1985-1986) 204

IX. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 208
A. Summary 208
1. Canadian Wheat Board Proposal - Pay Railways 209
a. Cost Savings 210
b. Policy Adjustments 211
c. Production 211
d. Welfare 212
e. Grain Flows 214
f. Freight Costs 216
2. Method of Payment to Producers 217
a. Cost Savings 218
b. Production 218
c. Welfare 219
d. Grain Flows 222
e. Freight Costs 223
3. C.W.B. Proposal with Total Costing 224
a. Cost Savings 224
b. Production 224
c. Welfare 225
d. Grain Flows 227
e. Freight Costs 228
4. Mississippi River Alternative 230
a. Cost Savings 230
b. Production 231
c. Grain Flows 231
d. Freight Costs 232
B. Conclusions 233
C. Recommendations 234

BIBLIOGRAPHY 236

APPENDIX A. 245

APPENDIX B 294

APPENDIX C 298

APPENDIX D 301

APPENDIX E 304

APPENDIX F 307
    A. Marginal Analysis 309
    B. Post - Optimal Analysis 311
    C. Range Analysis 312
    D. Parametric Programming 319

List of Tables

I.1 Total Exports of Canadian Grain (1976-1986) 2
IV.2 Static Potential Production Opportunities 46
III.3 Proposed Pricing Policy Options 46
IV.4 Actual Grain Shipments Via West Coast (1982-1987) 47
IV.1 Baseline Predicted Crop Production (1982 - 1987) 51
IV.2 Absolute Percent Error in Crop Production (1982 - 1987) 52
IV.3 Baseline Producer Surplus (1982 - 1987) 53
IV.4 Baseline Grain Flows (1982-1987) 54
V.5 Grain Flows with Increased Capacity 56
IV.6 Baseline Grain Shipping Costs (1982-1987) 59
IV.7 Increased Capacity - Transport Costs 65
V.1 Simulated Initial Crop Production (1982-1987) 69
V.2 Estimated Producer Welfare (1982-1987) 70
V.3 Changes in Consumer Surplus (1982-1987) 71
V.4 Grain Flows under the C.W.B. Proposal 73
V.5 Grain Flows with Increased Capacity 75
V.6 Grain Shipping Costs (1982-1987) 78
V.7 Shipment Costs - Maximun Capacity 84
V.8 Cost Savings Scenario A-1 (1982-1987) 88
V.8 Cost Savings Scenario A-2 (1982-1987) 90
V.10 Producer Surplus - Cost Scenario A-1 (1982-1987) 97
V.11 Producer Surplus - Cost Scenario A-2 (1982-1987) 98
V.12 A-1 Consumer Surplus Changes (1982-1987) 99
V.13 A-2 Changes in Consumer Surplus (1982-1987) 101
V.14 Adjusted Freight Costs with A-1 Savings 108
V.15 Adjusted Freight Costs with A-2 Savings 112
VI.1 Simulated Crop Production (1983-1987) 119
VI.2 Simulated Producer Surplus (1983-1987) 121
VI.3 Changes in Consumer Surplus (1983-1987) 122
VI.4 Baseline Grain Flows Under Total Coasting 124
VI.5 Baseline Grain Flows - Increased Capacity 126
VI.6 Transport Costs: Pay the Producer Scenario 129
VI.7 Total Transport Costs Under Increased Capacity 134
VI.6 Cost Savings Under Scenario B-1 137
VI.10 Adjusted Producer Surplus (1983-1987) 142
VI.11 Consumer Surplus Change after Adjustments 144
VI.12 Adjusted Transport Costs with B-1 Savings 148
VI.1 Simulated Crop Production, (1983-1987) 151
VI.2 Simulated Producer Surplus, (1983-1987) 153
VII.3 Changes in Consumer Surplus, (1983-1987) 154
VII.4 Grain Flows: St. Lawrence Pricing 156
VII.5 Transports Costs under St. Lawrence Pricing 159
VII.7 Cost Savings under Scenario B-2 165
VII.7 Adjusted Producer Surplus (1983-1987) 171
VII.8 Changes to Consumer Surplus (1983-1987) 173
VII.9 Adjusted Transport Costs under St. Lawrence Pricing 177
VIII.1 Initial Producer Response 181
VIII.2 Optimal Grain Shipping Patterns 183
VIII.3 Grain Shipping Patterns - Increased Capacity 184
VIII.4 Provincial Breakdown on Shipping Costs 186
VIII.5 Grain Shipping Costs - Increased Capacity 188
VIII.6 Total Cost Changes under Cost Scenario C-1 190
VIII.7 Total Cost Savings under Cost Scenario C-2 191
VIII.8 Total Cost Savings under Cost Scenario C-3 192
VIII.9 Total Cost Savings under Cost Scenario C-4 193
VIII.10 Break Down of Welfare Effects - Scenario C-1 197
VIII.11 Welfare Effects - Cost Scenario C-2 197
VIII.12 Welfare Effects - Cost Scenario C-3 198
VIII.13 Welfare Effects - Cost Scenario C-4 198
VIII.14 Adjusted Freight Costs 206

List of Figures

I.1 Distribution Effect of Pooled Prices (1986-1987) 5
II.1 Production Possibility for Wheat and Barley 11
II.2 Isoquant Map Illustrating Beef Production 13
II.3 Production Possibility and Isoquant Map for Beef 15
II.4 Economic Effects of Trade 16
II.5 Price Equilibrium in a Single Geographical Region 20
III.1 Grain Redistribution Model 28
III.2 Locational Units - Alberta 30
III.3 Locational Units - Saskatchewan 31
III.2 Comparison of Barley Prices (1976-1984) 38
III.3 Total Derived Demand for Barley 41
III.4 Sub Regional Price Equilibrium - Barley 44
III.5 Sub Regional Price Equilibrium- Wheat and Canola 45
III.6 Welfare Effects in the Barley Market 50
V.1 Adjusted Wheat Production under Cost scenario A-1 92
V.2 Adjusted Barley Production - Cost Scenario A-1 93
V.3 Adjusted Canola Production - Cost Scenario A-1 93
V.4 Adjusted Wheat Production under Cost Scenario A-2 94
V.5 Adjusted Barley Production - Cost Scenario A-2 95
V.6 Adjusted Canola Production - Cost Scenario A-2 95
V.6 Wheat Transport Patterns under Cost Scenario A-1 103
V.7 Barley Transport Patterns under Cost Scenario A-1 104
V.8 Wheat Transport Patterns under Cost Scenario A-2 105
V.9 Barley Transport Patterns under Cost Scenario A-2 106
VI.1 Adjusted Wheat Production - Cost Scenario B-1 139
VI.2 Adjusted Barley Production - Cost Scenario B-1 140
VI.3 Adjusted Canola Production - Cost Scenario B-1 140
VI.4 Wheat Transport Patterns under Cost Scenario B-1 146
VI.5 Barley Transport Patterns under Cost Scenario B-1 147
VII.1 Adjusted Wheat Production under Scenario B-2 167
VII.2 Adjusted Barley Production under Scenario B-2 168
VII.3 Adjusted Canola Production under Scenario B-2 169
VII.4 Wheat Transport Flows under Scenario B-2 174
VII.5 Barley Transport Flows under Scenario B-2 175
VIII.1 Adjusted Production under each Scenario 196
VIII.2 Grain Flows - Cost Scenario C-1 200
VIII.3 Grain Flows through Export Position - C-1 201
VIII.4 Optimal Grain Flows - C-2 203
VIII.5 Grain Flows through Export Position - C-2 204

I. INTRODUCTION

A. Background

1. Importance of the Canadian Grains Sector

The prairie provinces are Canada's major grain producing areas. During the 1986-1987 crop year, total wheat production in Canada was 26 million tonnes, 96 percent of which was located on the prairies, 3 percent in Ontario and Quebec, and 0.17 percent in other provinces. Three principal coarse grains grown in Canada are barley, corn, and oats. Most Canadian barley and oats is produced in western Canada, 89 and 79 percent respectively.[1] Conversely, corn is produced mainly in Ontario and Quebec; production of this crop in these provinces during 1986 accounted for 98 percent of the total Canadian corn production. Canola is the principal oilseed crop grown in Western Canada, where 98 percent of total production occurs.[2] One can see that the feed deficit areas of Canada have three alternative sources of supply: Western Canadian feed grains, Ontario corn and barley, and United States (U.S.) corn.

Oilseed production in Canada is more regionally dispersed than is coarse grain production with rapeseed and flaxseed concentrated in western Canada and soybeans in southern Ontario. The vast majority of all rapeseed grown in Canada today is canola (low erucic acid and low glucoinrolate rapeseed varieties). During the 1986 crop year oilseeds were seeded on some 3.74 million hectares in Canada which produced 5.6 million tonnes.[3]

The major crop exports are wheat, barley, and canola (Table I.1) . The Canadian grains commission reported 1986 exports of grains and oilseeds (excluding corn, soybeans, and wheat flour) of 28 million tonnes. This total includes wheat exports (including durum wheat) of 18.3

---

[1] The next largest barley and oats producing region in Canada during the 1986-1987 crop year was Ontario, (8 percent of oats and 6 percent of barley).

[2] Canada Grains Council, *Canadian Grain Industry Statistical Handbook 87*, Winnipeg, Manitoba, 1987.

[3] Constituting this 3.74 million hectares is 2.7 million hectares of rapeseed (canola), 615 and 453 thousand hectares of flaxseed and soybeans respectively. Also during 1986, 3.7 million tonnes of rapeseed (canola), 1.1 million tonnes of soybeans, and 754 thousand tonnes of flaxseed were produced.

million tonnes (65 percent), barley exports of 6.5 million tonnes (23 percent), and canola exports of 2.1 million tonnes (7.5 percent). The remaining grain exports (1.2 million tonnes) occurs in the form of oats, flaxseed, and rye, (4.37 percent). This suggests the export market for grain and oilseeds produced in Canada is significant to the western Canadian grains economy.

TABLE I.1 TOTAL EXPORTS OF CANADIAN GRAIN (1976-1986)

Million of Tonnes

CROP	WHEAT	OATS	BARLEY	RYE	FLAX	CANOLA	TOTAL
1976/77	11.01	0.49	3.60	0.17	0.36	1.01	16.64
1977/78	13.27	0.09	3.35	0.27	0.25	1.01	18.24
1978/79	10.95	0.02	3.55	0.15	0.49	1.72	16.88
1979/80	13.26	0.10	3.83	0.40	0.45	1.74	19.78
1980/81	13.49	0.05	3.24	0.45	0.51	1.37	19.11
1981/82	15.66	0.05	5.72	0.55	0.40	1.36	23.74
1982/83	18.27	0.10	5.33	0.25	0.38	1.27	25.60
1983/84	18.74	0.12	5.27	0.74	0.53	1.50	26.90
1984/85	15.25	0.02	2.60	0.36	0.52	1.46	20.21
1985/86	15.93	0.04	3.59	0.23	0.57	1.46	21.82
1986/87	18.39	0.25	6.53	0.17	0.66	2.13	28.13

Adapted from Canada Grains Council, *Canadian Grains Industry Statistical Handbook 87*, Canada Grains Council, Winnipeg, Manitoba, 1987

2. The Canadian Wheat Board

The Canadian Wheat Board (C.W.B.) is a centralized selling agency for prairie wheat, oats, and barley for both export and domestic human consumption. In addition, the C.W.B. has the responsibility of marketing these grains to domestic feed grain markets when shortages occur, but producer supplies (sales) to the domestic feed grain markets, controlled by private trade, have been adequate enough to meet the derived demand (intermediate level demand) for these feed grains. Essentially the C.W.B. is a residual supplier in the domestic feed grain market but is not an active participant in that market. The C.W.B. which is incorporated under an Act of Parliament has two stated objectives.

A. The Board is incorporated with the objective of marketing in an orderly manner, in interprovincial and export trade, grain grown in Canada.

B. The Board shall sell and dispose of grain acquired by it pursuant to its operations under the C.W.B. act for such prices as it considers reasonable with the object of promoting the sale of grain produced in Canada in world markets.[4]

3. Price Pooling

In order to stabilize producer returns while ensuring that each producer receives an equitable share of the market, the board employs a price pooling mechanism.[5] The primary objective of price pooling is to share market risks among all prairie grain producers. Two fundamental procedures are involved in price pooling:

A. An initial payment is paid to the producer upon delivery of grain to the primary elevator. This initial payment is a guaranteed floor price for each type of grain, set by the federal government in coordination with C.W.B. recommendations.[6] The value of grain in each pool account is determined when all grain has been sold and adjustments have been made for marketing costs. Marketing charges consist of: interest, insurance, storage, terminal elevators' handling charges, and C.W.B. own operating costs. Also, costs associated with producer freight costs from primary elevators to terminals and primary elevator handling charges are deducted from the initial payment.

B. A final payment is determined and distributed among producers after the pool account has been closed at the end of the marketing year. This gives each producer who has delivered grain to the pool an equitable share of any surpluses which has occurred in the pool account.

Receipts which the board obtains from the sale (both domestic and foreign) of a particular grade are "pooled" in a single fund. Separate pools are established and maintained each year for six kinds of grain: the main wheat account (hard red spring wheat, winter wheat, utility wheats, and soft white spring wheat), durum wheat, feed barley, malting or selected barley, oats, and selected oats. These pools consist of the quantities of grain delivered by farmers during a crop year (August 1 to July 31).[7] Initial prices for the base grade in each pool account are established by the Federal

---

[4] C.W.B. Act, October 19, 1987, pp. 4.

[5] "Canadian Wheat Board price pooling is a mechanism by which:
1. timing of sales are pooled,
2. sales opportunities are pooled,
3. infrastructure constraints are shared, and
4. costs incurred by the C.W.B. are shared."
(Olsen, B. T. and H. G. Brooks, 1986).

[6] Initial payment can also be thought of as an advance towards a higher final payment in the case that the grain is sold for a higher net price after adjustments for marketing costs. The federal government under the C.W.B. Act may increase the level of the initial payment during a crop year, but is not permitted to reduce it.

[7] Canadian Grains Institute, *Grains and Oilseed, Handling, Marketing, Processing*, 1975.

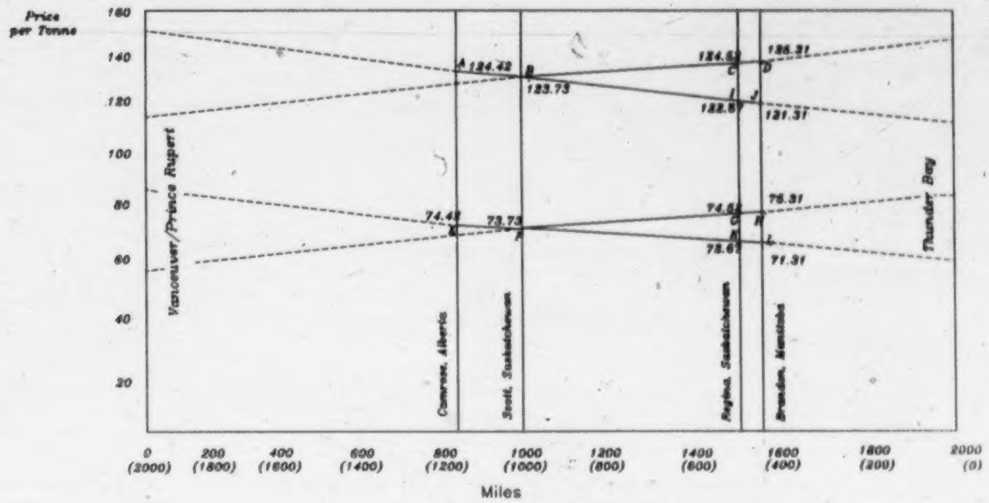
Government, with input from the C.W.B. The C.W.B. sets initial prices for all other grades. Through this system all producers receive the same basic average price (except for differences in internal transportation costs) for the same grade of grain which is sold during a given crop year regardless of the origin and particular day and month of sale.

The C.W.B. also engages in a regional pooling policy of returns from grain sales. The approach involves pooling sales from both Thunder Bay and the West Coast markets. The focus of this study is on the consequences and the distribution of costs and benefits associated with pooling producer returns from the different export ports.

Figure I.1 illustrates wheat and barley locational relationship over the C.W.B. designated region using 1986-1987 rail adjusted initials at Camrose, Scott, Regina, and Brandon. Line ABCD represents the initial price for No. 1 C.W.R.S. ($130/tonne) net of 1986-1987 freight to either Thunder Bay or Vancouver. Line EFGH represents the initial payment for No.1 feed barley ($80/tonne) net of 1986-1987 freight to either Thunder Bay or Vancouver. This diagram illustrates that the current pooling mechanism results in lowest market returns in the mid section of the prairies and prices increasing as distance to export position decreases.

One possible alternative announced by the Canadian Wheat Board (C.W.B.) in Grain Matters in November of 1985 is to change the price basing point. It was proposed that all grain sold to the C.W.B. be based on the transportation charge to Vancouver or the St. Lawrence, whichever was lowest. This would suggest that producers situated in the eastern Prairies would bear a larger part of the cost of grain movement than has been the case in recent years. In fact, all producers would be deducted the West Coast rate. The C.W.B. would still continue to pay seaway costs and these costs therefore would be shared among all grain producers shipping grain to export position. Under the current Western Grain Transportation Act, charging all grain producers the Vancouver freight rate does not, in fact, reduce Thunder Bay marketing costs unless the grain actually is moved through the West Coast. Also, increasing freight rates to all producers shipping to Thunder Bay by the Vancouver freight rate reduces the initial price of grain but does not reduce the additional costs incurred by the specific pool accounts.

Under the new C.W.B. proposal, if all grain were able to move westward, then Saskatchewan producer returns would be below Alberta, but above Manitoba returns for both wheat and barley. Consequently, all grain does not move westward because an export constraint exists on the total tonnage that can go through the West Coast.



Distance from Vancouver (Thunder Bay)

Line ABCD represents the initial price for No. 1 CWRS ($130/tonne) Net of 1986/87 freight to either Thunder Bay or Vancouver.

Line ABIJ represents the initial price for No. 1 CWRS ($130/tonne) net of 1986/87 freight to either Vancouver or the St. Lawrence (All points are lowest freight to Vancouver.)

Line EFGH represents the initial payment for no. 1 Feed Barley ($80/tonne) net of 1986/87 freight to either Thunder Bay or Vancouver.

Line EFKL represents the initial price for No. 1 Feed Barley ($80/tonne) net of 1986/87 freight to St. Lawrence or Vancouver.

Figure I.1 Distribution Effect of Pooled Prices (1986-1987)

4. Problem Statement

Preliminary evidence based on C.W.B. export prices for 13.5 percent No. 1 Canada Western Red Spring (C.W.R.S.) wheat, results in a West Coast premium of $21/tonne during the 1984-1985 crop year.[8] Approximately 47 percent of prairie produced wheat is shipped through Thunder Bay.

---

[8] Canadian export prices represent C.W.B. official "in store" prices converted to fob at current fobbing rates. (International Wheat Council, 1985)

Under the present pooling arrangements, producers shipping to the West Coast (including most Alberta and western Saskatchewan farmers) share such premiums with those producers who ship through Thunder Bay. Consequently, producers in the western portion of the prairies are subsidizing those producers on the eastern portion of the prairies.

Marketing policies of the C.W.B. encourage maximizing grain exports through the west coast because of price premiums available at Vancouver/Prince Rupert. However, few have recognized the tendency for a regional distribution of benefits implicit in the pooling of grain sold from the West Coast and Thunder Bay. This will become an issue as increasing rail costs encourage grain shipments to the closest port, and is of importance to the Alberta grain producer whose shipments are among those attracting the so-called "West Coast premium".

The current practice of pooling all receipts from the export of grain does not adequately reflect the farm gate price of those producers supplying the West Coast. This has led some to question the distributional aspects of price pooling.

The research problem in this study is to analyze the regional redistribution of production and shipping, and the regional market price effects of pooling.

Emphasis in this study is placed on the spatial effects of price pooling and not on the time dimension.

Some producers gain through the distribution of benefits of West Coast sales to all grain producers delivering to the Canadian Wheat Board. Producers who gain through price pooling have a tendency to ship their grain through the Board market. The result is an increase in the opportunity cost of domestic sales, in that less grain is supplied to the feed grain market and more grain is shipped into the export market. The benefit from West Coast sales results in higher feed grain prices for western livestock producers. Therefore, a smaller proportion of prairie feed grains move off the prairies into central and eastern Canadian markets, causing these regions to use more Ontario feed grain, produce more local grain, and import the remainder. To date estimation of the total benefits and costs of spatial price pooling has not been carried out.

The distribution of income is viewed important in this study. A main question studied in this thesis is to assess the effect of price pooling by the C.W.B. on the regional distribution of income.

B. Objectives

The objectives of this study consist of the following:

1. To assess the size of a West Coast premium by the use of an interregional grain trade model;
2. To measure the effect on regional grain production by altering producer prices at various locations in the prairie region; and
3. To review alternative methods of changing regional patterns of grain prices and to provide a preliminary assessment of welfare effects.

C. Hypotheses

The primary hypothesis is that the regional pattern of prices affects the distribution of income to grain producers across the prairies.

This study tests the following hypotheses:

1. H_0 = There is no effect on regional grain production from altering producer prices.
2. H_0 = There is no difference in producer returns by altering producer prices at certain points on the prairies.

D. Sources of Data

Data obtained for this study was gathered from several sources. The data pertaining to production of grains and oilseeds for agricultural producing areas in the prairies were obtained from Statistics Canada's Regional Office in Ottawa. Lake transportation costs from Thunder Bay to St. Lawrence Ports were obtained from the *Grain Trade of Canada*. Rail charges from each of the 7 supply districts to the two exporting or trans-shipping points were obtained from the *Canadian Freight Association*. Levels of quota for Spring Wheat were obtained from various issues of *C.W.B. Annual Reports*. Initial prices for wheat and barley were also obtained from various issues of *C.W.B.*

annual reports. Finally, the future price for canola was obtained from various issues of the *Canadian Grain Statistical Yearbook*. Logistics costs such as the costs of movement of grain from farm to country elevator and country elevator storage and handling are not considered in this study.

E. Plan of Study

This study proceeds by reviewing economic theory, specificately spatial equilibrium and resource allocation. Chapter Three deals with the empirical specification of the grain redistribution model. The following five chapters deal with empirical testing and analysis of the grain redistribution model. Chapter Four concentrates on the baseline scenario, that is, production and grain flows under the existing transportation policy. Analysis of the C.W.B. proposal under pay the railway method of payment of the Crow Benefit is the topic of Chapter 5. Chapter 6 analyses the impact of a change in the method of payment. The C.W.B. proposal under a method of payment to producers is discussed in Chapter 7. The introduction of a third export point, the Mississippi River, under a method of payment to producers is analyzed in Chapter Eight. The final chapter contains a summary, conclusions, and recommendations for further research.

II. THEORETICAL CONSIDERATIONS

Allocation of scarce resources through decisions involving choice is a basic principle underlying economic theory. The analysis of resource allocation is mainly concerned with questions of what goods are produced and in what quantities; what methods are used in production and with what factor inputs; and how goods are distributed to members of society. Firstly, the assumption underlying economic management, maximization of total welfare, is employed in this analysis. Resources are said to be efficiently allocated when a change in output mix, production technology or distribution fails to increase total welfare (Pareto optimality condition). It follows that resource allocation is mainly concerned in identifying the most efficient production and distribution pattern and establishing decisions that will achieve maximum efficiency, or at least to an improvement in efficiency.

This chapter will attempt to explain the theory of resource allocation in answering the questions of how much of each commodity should be produced and how should this output be allocated. Resource allocation in this context assumes that producers and consumers are located at a single point. Within such a market there are no costs of moving products through space. Spatial equilibrium is then introduced into the analysis, relaxing some underlying assumptions, to analyze the spatial distribution and segregation of production and consumption. In this section a single product specification is investigated, to illustrate how a region may obtain a higher level of welfare through a specific economic activity.

The usage of the terms "market" and "region" may be somewhat confusing in the analysis. Market is an economic matter and not a geographical issue (region). Bressler (*et. al.*,1970) defines a market as an area or setting within which producers and consumers are in communication with one another, where supply and demand conditions operate, and the title to goods is transferred. In this communication process, prices are established, and these prices move up and down in response to changes in the underlying supply and demand forces. Price determination through such a complex system of interrelated commodity and factor markets becomes the primary conductor of economic activity.

A. Resource Allocation and Trade

Resource allocation can be examined from several viewpoints. These viewpoints are thought generally in the context of trade between individuals, regions and/or nations. Trade enables these different economic units to obtain a higher level of real income or utility through the process of exporting cheaply produced goods and importing goods that others can produce more cheaply. In other words, an individual, country, or region has a comparative advantage in the production of a good if its production costs are lower than those of other economic units at existing prices. The comparative advantage idea suggests that the costs of producing additional units of output is considered in relation to the reduction necessary in the production of other goods. For example, for a producer to increase wheat production requires a rearrangement of resources such as land and labor, in doing so, the producer may have to give up the opportunity to produce some units of barley, and canola. This theory, comparative advantage, suggests that one compares the opportunity costs of imports of barley and canola to domestic prices of these crops. It follows that quantities of barley and canola will be imported only if the imported price is less than the opportunity cost of producing an extra unit at home. Since in the short-run economic resources are in fixed quantities, consumers and producers in each region through specialization and trade, can escape from the limited combinations of products available from only domestic resources.

The concept of resource allocation and trade is best explained through an example at the farm level. A primary producer is mainly concerned about the competitive, complementary, and supplementary relationships that exist among farm enterprises. The main concern involves combining enterprises in such a way to take advantage of the supplementary and complementary enterprises. The combination of such resources will lead to an overall increase in producer welfare.

The appropriate combination of products can be seen from the production possibility curve, (isoresource curve), in Figure II.1. This figure shows how a given supply of land, capital, and labor will permit the production of barley and wheat in the appropriate combinations such that the producer receives the maximum dollar for each dollar of input. A production possibility curve depicts the combinations of outputs that can be derived from the available and current state of technology. Thus, the combinations that fall on the isoresource curve represents the maximum amount of output that can be attained given the producer's present resource base.

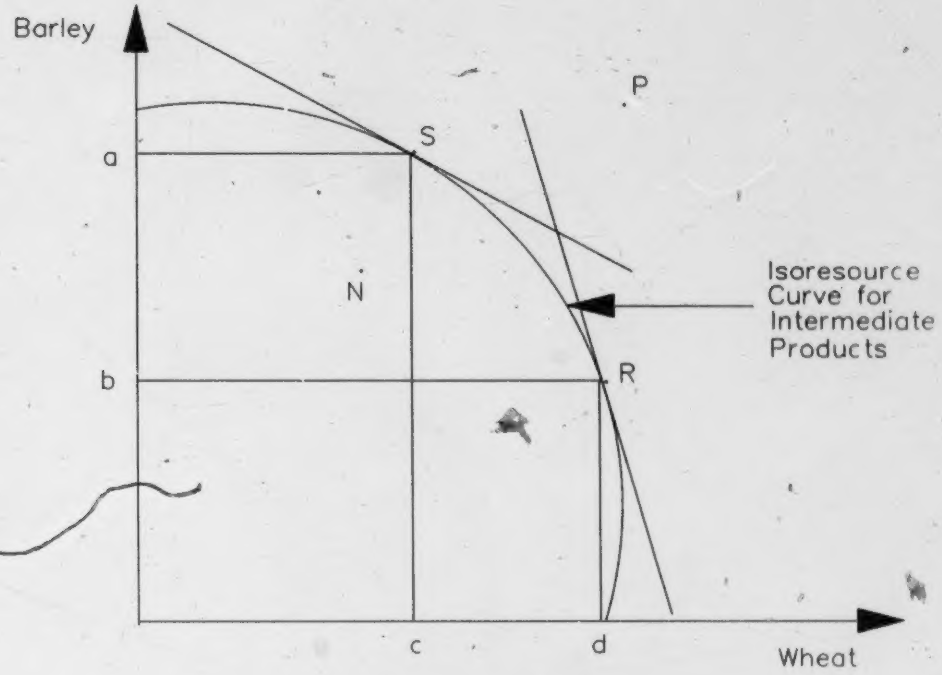


Figure II.1 Production Possibility for Wheat and Barley

However, combinations such as N, are also attainable since they lie within the production possibility curve. Producers may find themselves at point N if there are unemployed resources, or if resources are inefficiently used in production even though all resources are being employed. On the other hand, combinations such as P are unattainable, since they require more resources than are available. Efficient production, therefore, only occurs at points on the frontier. Technology is said to be inefficient if it is possible to increase the production of one good without producing less of another good, merely making better use of existing resources. Further, the downward slope of the isoresource curve indicates there is an opportunity cost of producing an additional amount of either product. The marginal rate of product substitution (MRPS) is the slope of the isoresource curve.

Suppose that a change in prices comes about because of the implementation of a new policy. This policy change causes an increase in wheat prices relative to barley prices. This will cause a change in the pattern of production from S to R. The result is an increase of CD in the production of wheat, the opportunity cost of which is a reduction of AB in the production of barley. The production optimum, therefore, is concerned with the optimal use of resources in producing a given set of outputs, and the optimum position is attained where it is impossible to increase the output of one commodity without decreasing that of another.

In a mixed farming operation, livestock enterprises differ from that of the crop enterprise, in that, inputs, such as feed in livestock production, i.e. beef, are transferred from the cropping enterprise. Products that are grown on farms and used as inputs into other farm enterprises are generally referred to as intermediate products. For example wheat and barley are intermediate products for livestock enterprises in this illustration.

Further, suppose that the livestock enterprises selected by the farmer has an isoquant map as shown in Figure II.2. This isoquant map is derived from a production function depicting beef production as a function of the amount of wheat and barley fed.

Each isoquant in Figure II.2 is the locus of all combinations of wheat and barley that produce the same level of output (beef). Following is a general form of a function for beef production;

$$\upsilon = f(wheat, barley) \qquad (2.1)$$

The above isoquants are obtained by rearranging the production function, so that, one input (barley) is a function of wheat while output υ^* is held constant. Thus the equation for an isoquant function for output υ^* is:

$$barley = f(wheat, \upsilon^*) \qquad (2.2)$$

The rate of technical substitution (MRTS) of barley for wheat is given by the slope of the isoquant in equation 2.2. The MRTS measures the rate at which one input (barley) substitutes for wheat as one moves along the isoquant. Mathematically, the MRTS can range anywhere from minus to plus infinity. Therefore at any point on an isoquant the slope is equivalent to:

$$MRTS_{(wheat, barley)} = \delta\frac{barley}{wheat} \; (\upsilon = \upsilon^*) \qquad (2.3)$$

or,

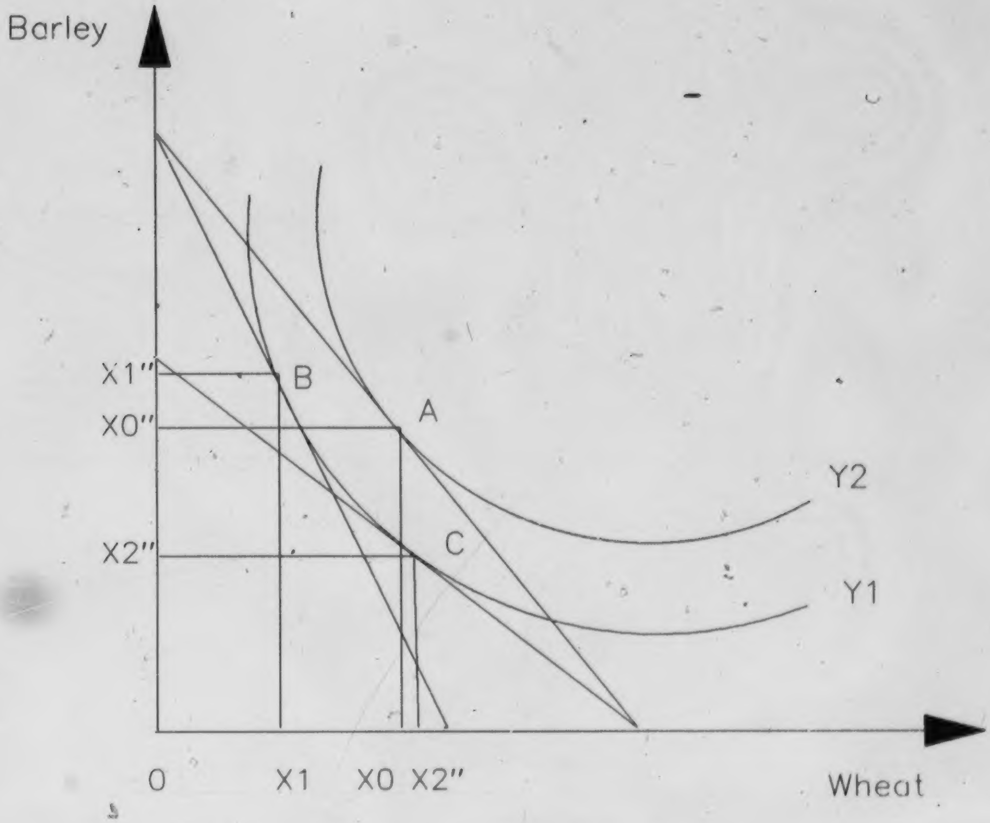


Figure II.2: Isoquant Map Illustrating Beef Production

$$MRTS_{(barley,\ wheat)} = \frac{1}{MRTS_{(barley,\ wheat)}} \tag{2.4}$$

Further, the producer faces a budget constraint which limits the amount of total expenditures on the two inputs, wheat and barley; at a fixed number of dollars, C^0. Therefore, the budget constraint faced by the producer can be written as follows:

$$c^0 = \omega_1 wheat + \omega_2 barley \tag{2.5}$$

Where ω_1 and ω_2 are the input prices for wheat and barley.

In Figure II.2 the budget constraint in equation 2.5 is placed in factor-factor space on top of a family of isoquants. The point of tangency between a particular isoquant and isocost line represents the minimum cost combination of wheat and barley that can be used to produce a fixed level of livestock, (beef), output.

Initially, assume that the optimum level of output occurs at point A on isoquant Y_2 (Figure II.2). Point A represents the most economic efficient level of beef production.

This factor-factor model (Figure II.2) can also be used in analyzing the behavior of producers towards changes in grain pricing policies. First assume that this policy change causes wheat prices to increase at a faster rate than barley prices. There will be a shift (decline) of livestock production from Y_2 to Y_1, that is, less wheat (x_0 to x_1) and more barley (x_0'' to x_1'') will be used as inputs into the livestock enterprises, (point B). On the other hand, if barley prices increase faster than wheat prices, production would still remain at Y_1, but more wheat (x_0 to x_2'') than barley (x_0'' to x_2'') would be used as inputs into the livestock enterprises, (point c).

The problem facing many farm managers in a mixed farming operation, is how to combine wheat and barley production in such a way that it maximizes beef production from the limited resources. Figure II.3 indicates the highest possible level of beef production, where the isoquant is tangent to the production possibility curve. The solution in this case is independent of input and product prices.

In Figure II.3 OB represents the amount of wheat while OA indicates the amount of barley grown. At point c, the point of tangency, the marginal rate of product substitution (MRPS) of wheat for barley is equal to the marginal rate of substitution (MRS) of wheat for barley; therefore, the MRPS in production is equal to the MRS in consumption. Economic efficiency (pareto optimum) is then reached at this tangency point. Economic efficiency is defined as global efficiency or pareto efficiency. The necessary conditions for pareto-efficiency are that the rate of commodity substitution for any two inputs (i.e. wheat and barley) in consumption should be equal to the rate of product transformation for the same two commodities in production, and both should be equal to the ratio of commodity prices, since the same prices prevail for consumers and producers under perfect competition:

$$MRTS_{(wheat,\,barley)} = RPT_{(wheat,\,barley)} = \frac{P_{wheat}}{P_{barley}} \qquad (2.6)$$

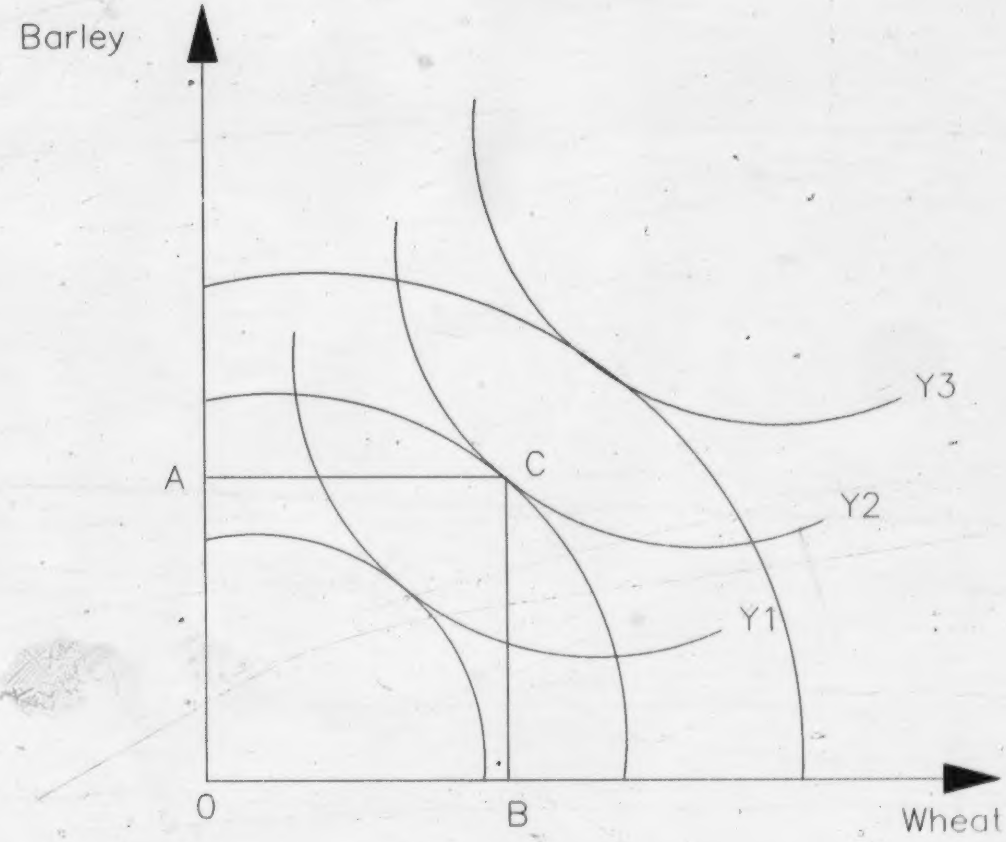


Figure II.3: Production Possibility and Isoquant Map for Beef

Figure II.3 represents a situation where no intermediate products are directly sold to the market but these are marketed through a secondary enterprise, livestock. In other words, this farm is self sufficient, in that what is produced is consumed on the farm and no crops are permitted to directly go to market. Further, it would be coincidental if the isorevenue line was tangent at the same output (wheat, barley) combination as MRPS and MRS. Since input and output prices are irrelevant, Figure II.3, represents a similar case to a closed economy analysis, where trade in intermediate products is not permitted.

A more typical situation is illustrated in Figure II.4, where a isorevenue line is included in the analysis. The tangency point of the isorevenue and isoproduct curve occur at a different point than that determined by the tangency of the isoquant and opportunity curve. The prices of the intermediate products wheat and barley, suggest a rotation that includes less barley and more wheat, than the rotation that maximizes production, point C.

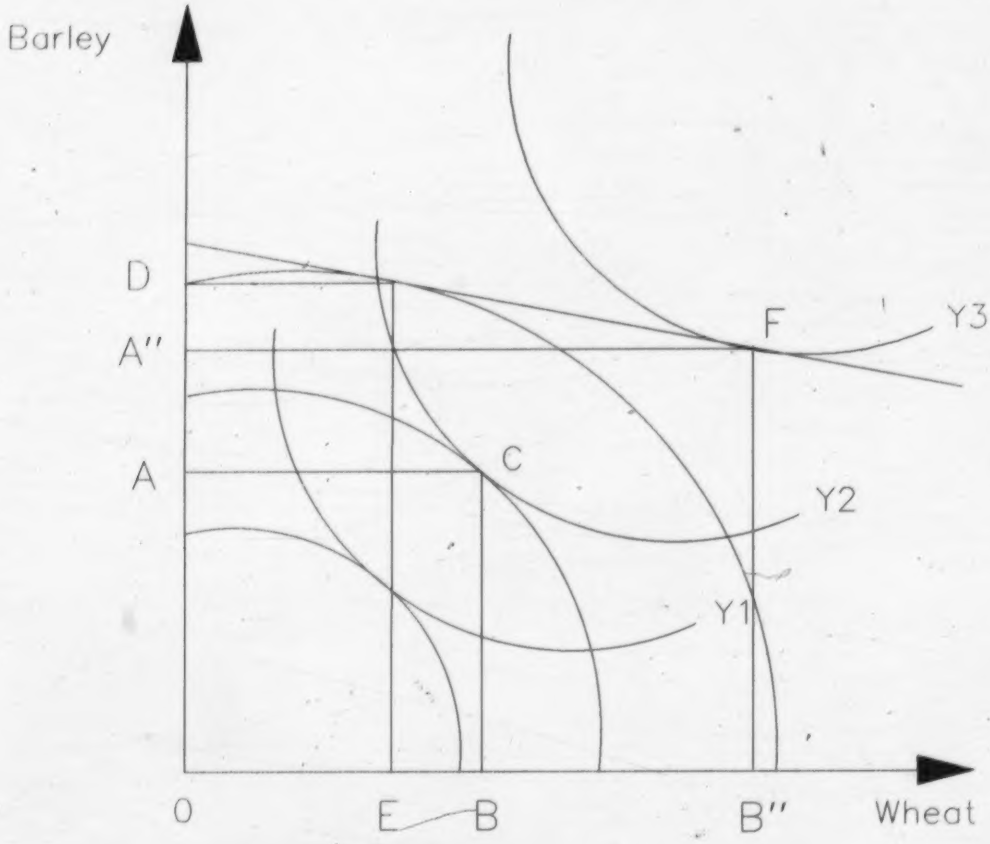


Figure II.4: Economic Effects of Trade

The isorevenue line traces all combinations of products which give the same level of revenue. In Figure II.4, the combination OD of barley and OE of wheat is equivalent in value to combination OA'' of wheat and OB'' of barley needed to increase beef production to a level on isoquant Y_3. The combination of OD and OE does not enable the farmer to produce on isoquant Y_3; but permits an excess of barley and a shortage of wheat production. Given the market prices, the producer would sell $A''D$ of barley and purchase EB'' of wheat. This trade increases beef production from isoquant Y_2 to Y_3. As can be seen, this illustration demonstrates the advantage of trade, in an open economy.

In this analysis the producers' objectives for both the product-product and factor-factor relationships are met. The maximum possible returns from the intermediate products are obtained and the output of the secondary product is produced at the least cost combination. Further, it should be noted that the equilibrium point on isoquant, Y_3, (point F), represents a least cost combination of beef production but it may not represent a profit maximizing combination. If the final equilibrium amounts are not optimum, the manager will either sell more barley, buy less wheat, and produce fewer livestock, or will add livestock units until the added returns equals the added costs.[9]

B. Spatial Equilibrium and Trade

The theory of spatial equilibrium has evolved since the 1930's. Problems which are considered in the theory of spatial equilibrium or optimal location are of the following form:

1. The optimal location of a firm with a given production program;
2. the optimal level of production at a given location;
3. the exchange of goods and factors between regions (locations);
4. the difference in prices and factor earnings between regions (locations).

The problem concerning equilibrium among spatially separated markets was formulated by Cournot-Enke in a 1951 article:

> **... Three or more regions trading a homogeneous good. Each region constitutes a single and distinct market. The regions of each possible pair of regions are separated but not isolated by a transportation cost per physical unit which is independent of volume. There are no legal restrictions to limit the actions of the profit-seeking traders in each region. For each region the functions which relate local production and local use to local price are known and consequently, the magnitude of difference which will be exported or imported at each local price is also known. Given these trade functions and transportation costs, we wish to ascertain: (1) the net price for**

---

[9] Doll, John P., and Frank Orazem. *Production Economics, Theory and Practice*. Second Edition. John Wiley and Sons, New York, 1978.

> **each region; (2) the quantity of exports or imports for each region; (3) which regions export, import, or do neither; (4) the volume and direction of trade between each possible pair of regions ...**[10]

In the Cournot-Enke problem, domestic demand and supply functions are given for a n-regional market involving one commodity (i.e. wheat) and are specified in terms of its market price at a particular locality. Each region in the model was assumed to be separated from each other by exogenously determined per unit transportation costs.

The one commodity, i.e., wheat, n-regional model initially formulated by Cournot-Enke was later reformulated into a maximization problem by Samuelson. The objective function, net social pay-off was maximized. Samueleson's net social pay-off function was defined as consumer surplus plus producer surplus minus exogenously determined transport costs between each pair of regions. The main reason for converting the spatial equilibrium problem into a maximum problem is two fold:

1. To show how this purely descriptive problem in non-normative economics can be cast mathematically into a maximum problem; and
2. to relate the entire problem to a standard problem in linear programming, the so called Koopmans-Hitchcock minimum-transport-cost problem.

Takayama and Judge (1964) showed that given linear demand and supply functions in each region along with a matrix of transportation costs, Samuelson's problem involved the maximization of a quadratic function subject to a set of linear constraints.

In order to obtain a spatial equilibrium solution three conditions must be met. First, a good will move from a market where its price is lower to a market where its price is higher, until the difference in prices does not exceed transfer costs. The price differential has to equal transportation costs, if goods are actually exchanged in equilibrium. It follows from this, that the regional price structure will consist of commodity prices in region y, which is delivered to another region x, being exactly lower by the transportation costs than the prices for the same commodities in region x. In self sufficient regions price is determined by the interaction of demand and supply of that region alone. Second, it is assumed that the quantity of a good which is produced and consumed in a region is viewed as a trade flow to that region. Therefore, the demand in each region equals the trade flows to that region. Third, implicitly it is assumed that equilibrium prices and quantities must be on the supply and demand functions.

---

[10] Takayama T., and G.G. Judge. *Spatial Equilibrium and Quadratic Programming*. North Holland Publishing Company. 1971.

Trade between two regions can be viewed as an attempt to increase social welfare. Social welfare in this context represents the summation of producer and consumer surpluses for each regional market. Trade in a spatial system has the effect of bringing the combined demands in a particular region to bear on the supply conditions. Graphically, the spatial equilibrium problem is solved by defining excess functions for the various interregional markets. Excess supply is defined as the amount of product which a producer is willing to supply the market at a given price over the amount that will be purchased at that price, and excess demand is the negative of excess supply. In Figure II.5, when the price is OP_2, the excess demand is X_4X_3 or CF, and when the price is OP_1, the excess supply is X_2X_1 or BA. At equilibrium, E, both excess demand and supply are zero. Since both are zero, there are no forces disturbing equilibrium. For example if excess demand is greater than zero, competition among buyers will force prices up; if excess demand is less than zero, or, alternatively, if excess supply is positive, competition among sellers forces prices down.

The impacts of trade are easily analyzed by integrating regional supply and demand functions. Pre-trade equilibrium for the i^{th} region is illustrated in Figure II.5. In this Figure, demand price is assumed to be a function of quantity demanded, whereas, the supply price is a function of the quantity supplied. Mathematically, the supply and demand relationships are expressed for the i^{th} region as follows:

$$P^i = \alpha^i - \beta^i Q^d \tag{2.7}$$

$$P_i = \theta_i + \omega_i Q^s \tag{2.8}$$

Where:

P^i, P_i = The demand and supply prices of a commodity in the i^{th} region.

θ_i, α^i = The intercept terms of the i^{th} regional supply and demand functions.

ω_i, β^i = Slope coefficients of the i^{th} regional supply and demand functions, relating supply and demand price to the corresponding quantity supplied and demanded.

Q^s, Q^d = Quantity supplied and demanded of a commodity in the i^{th} region.

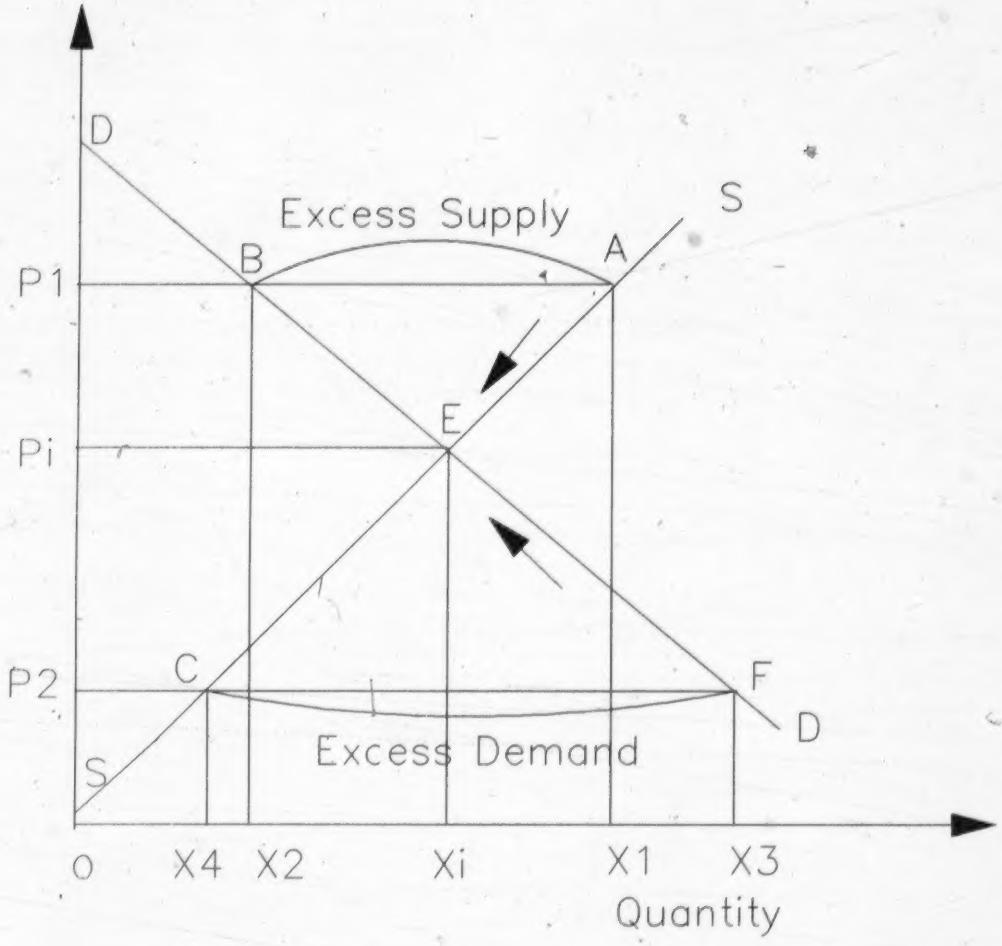


Figure II.5 Price Equilibrium in a Single Geographical Region

In order to analyze the benefits of trade, consumer and producer surpluses have to be derived to determine the level of social welfare for each region. Firstly, consumer surplus represents the difference between what was actually paid for a particular quantity of a commodity and the price the consumer would have been willing to pay rather than do without it (graphically, the area under the demand function less the area that represents the amount actually paid for the commodity).

Each point on a demand function represents the highest single price that consumers are willing to pay for the corresponding quantity of output. As indicated earlier some consumers are willing to pay more than forego consumption of a particular commodity.

The economic concept of consumer surplus emphasizes the fact that consumers receive more utility from a commodity than its market price indicates. The last unit purchased is just equivalent to the market price of that commodity, whereas, units previously purchased, in terms of satisfaction, are worth more to a consumer. This analysis assumes that the income effect (compensated demand) is zero, therefore, the oridinary and compensated demand curves coincide. "At this point the utility level achieved for the ordinary demand curve equals the level prescribed for the compensated demand curve, and the minimum income for the compensated curve equals the fixed income for the ordinary demand curve" (Henderson and Quant, 1980, pp.26). If equilibrium in the i^{th} region is at (P_i, X_i), then the consumers who paid more than P_i would benefit. Mathematically,

$$Consumers'\,Surplus = \int_0^{x_i} (\alpha^i - \beta^i Q^d)\,dQ^d - P_i X_i \tag{2.9}$$

Secondly, producer surplus is the difference between the prices at which producers would be willing to sell their products and the prices they actually receive, (economic rent). This economic rent is the quantity of money income over and above the level needed to produce X_i. Producer surplus represents gross returns to productive assets less all variable costs associated with producing X_i. These assets include such items as land, labor, and/or capital. With the underlying assumption that an aggregate supply function represents the marginal cost of producing an additional unit of output, producer surplus is graphically the area represented above the supply function but below the output price. The area below the marginal cost (supply) function represents payments to variable factors of production, thereby, the area above this function represents total returns to all fixed factors or producer surplus. Mathematically,

$$Producers'\,Surplus = P_i X_i - \int_0^{x_i} (\theta^i + \omega^i Q^s)\,dQ^s \tag{2.10}$$

Social welfare for any one region is defined as the algebraic are under its excess demand curve, which is equal in magnitude to the area under its excess supply curve but opposite in algebraic sign. Also, in the absence of externalities, total welfare for any one region represents the summation of producer and consumer surplus. Mathematically, total welfare in a single region can be determined by summing the results of the areas under the supply and demand functions as follows:

$$Social\ \ Welfare = \int_0^{x_i} (\alpha^i - \beta^i Q^d)\,dQ^d - \int_0^{x_i} (\theta^i + \omega^i Q^d)\,dQ^S \tag{2.11}$$

Therefore, in the n region, one commodity case, ignoring t_{ij}, social welfare becomes:

$$Social\ \ Welfare = \sum \left[\int_0^{x_i} (\alpha^i - \beta^i Q^d)\,dQ^d - \int_0^{x_i} (\theta^i + \omega^i Q^d)\,dQ^S \right] \tag{2.12}$$

If in equation 2.11, $Q^d = Q^s = X_i$ (Figure II.5), then the first term in the integral equals the area EP_i, and the second term equals the area SEP_i. By subtracting the two integrals the remaining area is DES, the sum of producer and consumer surplus, or social welfare for the i^{th} region. The welfare function is now equivalent to the graphical model. Each excess supply region will then trade with consuming regions if its total social welfare is increased, that is, by seeking a profit through arbitrage by transferring a commodity to an excess demand region. Therefore, transportation costs must be defined for each pair of n regions. If t_{ij} represents the unit transportation costs between each pair of regions and x_{ij} is the trade flows between each pair of regions, total transportation costs can be defined as:

$$\sum\sum t_{ij} x_{ij} = T'X \tag{2.13}$$

Where:

$$T = (t_{11}, t_{12} \ldots t_{1n}, t_{21} \ldots t_{2n}, \ldots, t_{n1} \ldots t_{nn})_{(1xN^2)} \quad \text{and;}$$

$$X = (x_{11}, x_{12} \ldots x_{1n}, x_{21} \ldots x_{2n}, \ldots, x_{n1} \ldots x_{nn})_{(1xN^2)}$$

Since these transportation costs represent negative welfare to a region, the social welfare function for all n regions must be specified in definite integral form as:

$$\text{Social Welfare} = \sum\left[\ {}_0\!\int^{x_i}(\alpha^i - \beta^i Q_i^d)\,dQ^d - {}_0\!\int^{x_i}(\theta_i + \omega_i Q_{s,i})\,dQ_s\right] - T'X \qquad (2.14)$$

III. MODEL SPECIFICATION

A. Structure of Commodity Models

Spatial commodity models of various types have been developed for agricultural markets in Canada. A Commodity model, as defined by Labys (1973), is a "quantitative representation of a commodity market or industry, where selected behavioural relationships reflect the supply and demand conditions in price determination as well as other related economic, political and social phenomena". Commodity models may not be uniform. In fact any differences in models will reflect the structure of a commodity market, and detailed information required to obtain model objectives. Some of these spatial models consist of optimizing the location of production and shipment patterns by employing both linear and non-linear (quadratic programming) techniques, others are classified as equilibrium econometric flow models.

Quadratic programming related to spatial studies utilizes endogenously determined prices and quantities to determine the most efficient location of production and optimal trade flows in the context of producing and consuming regions. Quadratic programming consists of three components: (1) A system of equations describing the demand for a commodity (ies) in a consuming region (D_i) and supply of a commodity (ies) in a producing region (S_j). These equations consist of either quantity supplied and demanded as a function of prices or prices a function of supplies and consumption in the regions, (P_i or P_j). Mathematically, these equations are expressed in quantity or price dependent form as:

$$D_i = \alpha_0 - \alpha_1 P_i \qquad (3.1)$$

$$S_j = \beta_0 + \beta_1 P_j \qquad (3.2)$$

$$P_i = \frac{\alpha_0}{\alpha_i} - \frac{D_i}{\alpha_i} \qquad (3.3)$$

$$P_j = -\frac{\beta_0}{\beta_i} + \frac{S_i}{\beta_i} \qquad (3.4)$$

(2) the distribution of activities over space, and (3) the equilibrium conditions. Although supply and demand specifications in a quadratic programming framework consist of a similar structure to that

of equilibrium econometric models, the equilibrium process is more accurately represented through the maximization of profits. Profits in this context are defined as a positive price differential between two regions after deducting transportation costs. Profit maximization is obtained through the process of transferring commodities until demand equals supply in every spatially separated market. Further, quadratic programming allows the possibility of explicit constraints to determine the effects on prices and regional trade flows of given changes in supply and other exogenous variables. Quadratic programming models of this type were initially developed by Takayama and Judge (1964). The objective function was to maximize net social payoff defined by Samuleson (1952) as:

$$W = \int_{0}^{P'} D_i \delta P_i + \int_{P_j}^{P^*} S_j \delta P_j - \sum\sum c_{ji} X_{ji} \tag{3.5}$$

Where:

P^* = Intercept term of equation (3.1) on the price axis $\left(\frac{\alpha_0}{\alpha_1}\right)$

C_{ji} = The transportation cost of shipping one unit of commodity from region j to consuming region i.

X_{ji} = Exports of a commodity shipped from producing region j to consuming region i.

Subject to three equilibrium conditions:

$$\alpha_0 - \alpha_1 P_i = \sum_{i=0}^{\infty}\sum_{j=0}^{\infty} x_{ij} \tag{3.6}$$

$$\beta_0 - \beta_1 P_j = \sum_{j=0}^{\infty}\sum_{i=0}^{\infty} x_{ji} \tag{3.7}$$

$$P_i - P_j = c_{ij} \tag{3.8}$$

Where:

$\sum_{i=0}^{\infty}\sum_{j=0}^{\infty} x_{ij}$ = Total quantity received by region i from producing region j.

$\sum_{j=0}^{\infty}\sum_{i=0}^{\infty} x_{ji}$ = Total quantity shipped from region j to consuming region i.

Equations (3.6) and (3.7) are constraints associated with trade between the regions. First, equation (3.6) assumes that demand in each region equals trade flows to that region. Secondly, equation (3.7) ensures that production in a particular region will equal trade flows from that region. Equation (3.8) satisfies the Kuhn-Tucker conditions.[11] Welfare measures are not measured from the objective function, but rather from the individual demand and supply equations incorporated in the quadratic programming model. In summary, the main output from a quadratic programming model consists of determining:

1. Regional equilibrium prices;
2. regional supply and consumption; and
3. flows of interregional exchange.

Linear programming in transportation research, however, assumes that the objective function and constraints are linear, that is, the measure of resource usage must be proportional to the level of each activity conducted individually. This may become limiting if the objective function coefficients incorporated in the transportation model are not a linear function of the supply and demand constraints. This indicates that in the context of spatial equilibrium, quantities demanded by a consuming region and the quantities supplied by a producing region are fixed rather than price dependent.

The limitation of linear transportation models in solving spatial equilibrium problems is the assumption of fixed demand and supply, that is, there is no reaction to supply and demand prices in each region. Hence, the solution obtained from the model cannot be viewed as a global optimal solution but a conditional optimal solution under predetermined demand and supply conditions.

The advantages of linear transportation models have been specified by Koo and Larson (1985) as being simple, thus enabling easy interpretation. Apart from linear transportation models being simple, they are very efficient in terms of computer operation. These models have the advantage of formulating a large-scale model with great detail. Another advantage of linear over quadratic programming models lies with the net effects of changes in transportation activities being easier to determine, since quantities demanded and supplied are fixed in a linear programming model.

Econometric commodity flow models, on the other hand, consist of export or import equations and/or price linkage equations or identities to determine prices and trade flows. Theoretically, equilibrium econometric models consist of two parts: 1. A set of two equations, demand and supply composed of endogenous, exogenous, and predetermined variables. 2. An identity which assures that the market is "stationary" or in equilibrium. Statistical theory is than applied to the theoretical model. An advanced mathematical algorithm is then used in order to optimize the system. Equilibrium econometric models require more detailed information than in the quadratic programming framework. From the previuos discussion for a given specification of supply and demand no significant difference should exist between a quadratic programming and econometric flow model in spatial equilibrium analysis.

---

[11] The conditions necessary for a maximum or minimum to occur subject to inequality constraints are known as the Kuhn-Tucker conditions. The economic interpretation of these equilibrium conditions is that the difference in prices between any two regions can differ at most by the unit transportation costs.

B. Selected Empirical Methodology

The Canadian grain sector exists in a complex environment. The problem was to construct a model which is capable of reflecting this environment in such a manner as to be useful in explaining production and trade flows on a sub regional basis. A model consisting of an econometric sub model integrated with a production simulation and linear transportation sub model is well suited for the interregional competition and policy environment within western Canada, (see Figure III.1).

In this research all supply equations are estimated by ordinary least squares (OLS) techniques. All estimated supply functions are based on positive estimates rather than a normative (linear programming) estimate. This positive estimate is based on fitting a linear regression to historical data with least squared error. These estimates are used to determine new production levels under different policy scenarios, thus assuming past policies and relationships among variables will remain stable. Demand for feed grains is considered to be pre determined and trade to the two export ports, West Coast and Thunder Bay, is treated as exogenous to the system.

The baseline run consisted of three phases. Firstly, quantities of grains available for export from each producing region are determined by the use of a production simulation sub model. The model simply determines quantities of grain available from each producing region for export (based on supply responses and pre determined demand levels). Secondly, these quantities are used in a linear transportation sub model in order to determine the optimal flows of grains by minimizing total transport costs to export position. Thirdly, freight costs to producers, the C.W.B., and the Federal Government, based on optimal grain flows are calculated.

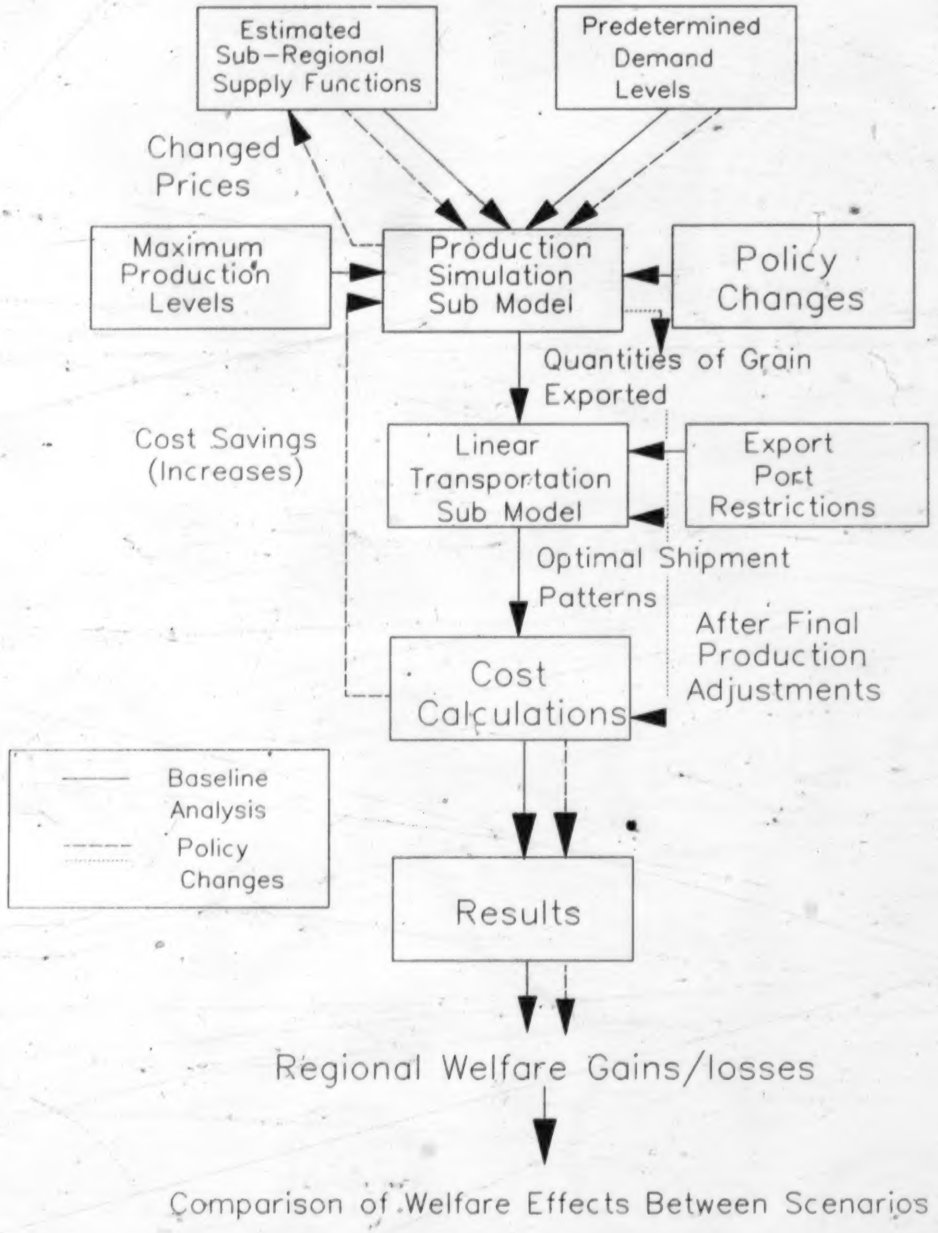

Estimated Sub-Regional Supply Functions
Predetermined Demand Levels
Changed Prices
Maximum Production Levels
Production Simulation Sub Model
Policy Changes
Quantities of Grain Exported
Cost Savings (Increases)
Linear Transportation Sub Model
Export Port Restrictions
Optimal Shipment Patterns
After Final Production Adjustments
Cost Calculations
Baseline Analysis
Policy Changes
Results
Regional Welfare Gains/losses
Comparison of Welfare Effects Between Scenarios

Figure III.1: Grain Redistribution Model

Following the baseline run, the production simulation model is then "shocked" with some grain policy changes. New export quantities from each producing region, optimal grain flows, and freight costs to the different participants in the grain and oilseed industry are determined. These optimal grain flows and costs under each different policy scenario are then compared to the baseline analysis to determine cost savings from changes in production and export levels. These cost savings are then inputed back into the production simulation, through prices, to determine adjusted production, exports, and final transport patterns and costs. Regional welfare gains and/or losses are then calculated between the two scenarios. Since the model has excess demand and supply functions in all the consuming regions (export regions) and producing regions, respectively, it satisfies the spatial equilibrium conditions discussed earlier in this study.

The main output from the model consists of predicting the effects on prices and regional trade flows of given changes in supply and other exogenous variables. Output from the model consists of the following:

1. Sub regional equilibrium prices;
2. Sub regional supply and consumption; and
3. Trade flows to export ports.

1. Data Selection

Estimation of parameters in this study are derived from 1965-1985 (N=20) annual data for three basic reasons. First, the prime concern of the study lies in providing a quantative framework for long run policy decisions such as those related to transportation and pricing. Second, the use of annual data represents a least-cost method of achieving desired results since neither monthly nor quarterly data are plentiful for grain commodities. Third, periods of both stability and instability are covered.

2. Geographic Areas

The model subdivides western Canada into seven producing regions. Therefore, the grain redistribution problem may be formulated after Enke (1951), as follows:

Areas considered in the analysis are divided into a finite number of regions where each region is represented by a single point in space (locational unit).

This spatial model will consist of the following areas:

1. Alberta consists of three locational units: crop reporting districts 1-3 as one area, crop reporting districts 4,5, and 6 as the second locational unit and crop reporting district 7 as the final area, (see Figure III.2).

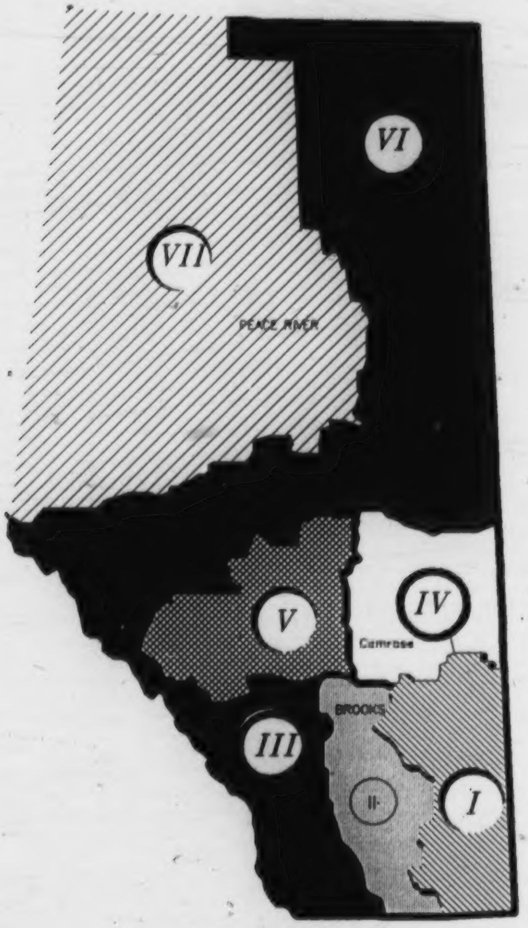


Figure III.2: Locational Units - Alberta

Adapted from *Agriculture Statistics Yearbook*, Alberta Agriculture, 1987

2. Saskatchewan consists of three locational units: crop reporting districts 7 and 9 as one, crop reporting districts 5,6, and 8 as the second unit and crop districts 1-4 as the third area, (see Figure III.3).

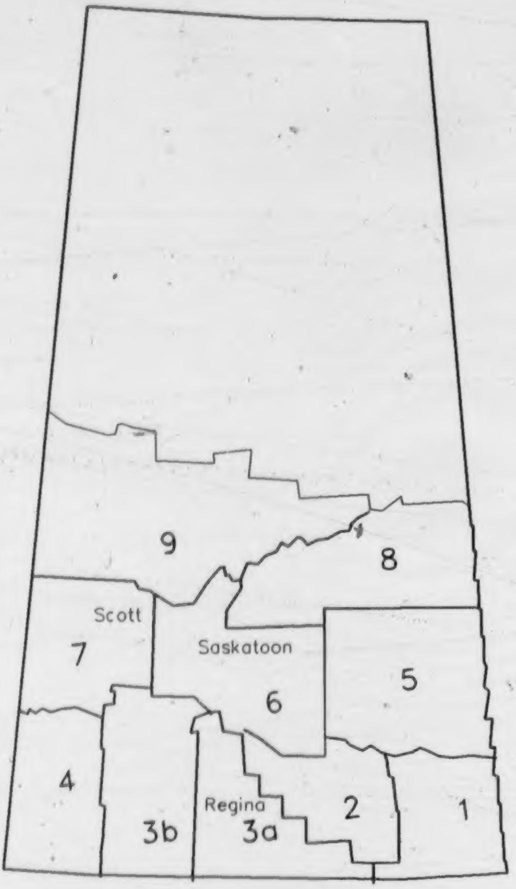


Figure III.3: Locational Units - Saskatchewan

Adapted from *Saskatchewan Agriculture Statistics Yearbook*, Economics Statistics, Saskatchewan Agriculture, 1986

3. Manitoba is treated as one area.

The producing areas were selected on the basis of production and present shipping patterns. In Manitoba, Thunder Bay tends to be the more logical port for export grains. No benefit would be gained by disaggregating the province of Manitoba into crop regions, since provincial crop production is a function of a weighted sum of all crop districts' responses. Therefore, the provincial impacts within the province of Manitoba in shipping patterns and crop production can be examined on a provincial basis. Saskatchewan, however, has a split in direction of grain shipment flows. These regions were divided on an east/west pattern. Although the closest port for Alberta is the West Coast, this province is disaggregated to allow sub regional impacts to be determined.

Also included in this analysis are two export ports, West Coast and Thunder Bay, as two separate demand areas. Geographical separation of the different producing and consuming regions delineates them as individual trading areas.

Grains (wheat, barley, canola, and oats) are exchanged between each sub region and the export ports. Since oats plays a minor role in prairie grain production and has remained fairly stable over the simulation period, it is assumed to have a fixed value (perfectly inelastic) for any one crop year and is included in the linear transportation sub model. Cost calculations to the producer, government, and C.W.B., from oats shipments are also determined. Trade which occurs between each sub region and the two export ports is viewed as an attempt to increase producer welfare. In this context producer welfare represents the area above each sub regional supply equation and below the equilibrium price (producer surplus).

This spatial equilibrium problem is one of measuring producer surplus subject to production and demand constraints for shipments between regions. Therefore, the spatial equilibrium problem represents an extension of the models discussed previously, that is, graphically excess supply functions are defined for each of the sub regions in western Canada, while sub regional demands are assumed fixed.

3. Supply Block

This commodity model consists of 21 supply responses. Supply responses for wheat, barley, and canola for each sub region were estimated. Basically, the conceptual models for these supply responses are similar. These supply functions consist of production ('000 Bu.) as a function of the farm gate price ($/Bu.) and various exogenous supply shifters. For each sub region the farm gate price represents the initial price minus transportation costs to the closest export port. Transportation costs are determined from the export port to a central location in each sub-region. These central points are illustrated in the following Table.

SUB REGION	CENTRAL LOCATION
1. Alberta 123	Brooks
2. Alberta 456	Camrose
3. Alberta 7	Peace River
4. Saskatchewan 14	Regina
5. Saskatchewan 568	Saskatoon
6. Saskatchewan 79	Scott
7. Manitoba	Brandon

The individual crop specifications rest on the premise that most planting decisions are made in the quarter prior to planting. It should be noted that the majority of crop supply functions in the literature have been estimated on an aggregate basis, thus limiting the usefulness in comparing elasticities and significance levels of the various explanatory variables to the results obtained in this study. In this study, the supply responses take the following general form:

$$A_{ij} = g(P_{ij}, S_{ij}) \qquad (3.9)$$

Where:

A_{ij} = Production of crop i in region j.

P_{ij} = Farm gate price of crop i in region j.

S_{ij} = Exogenous supply shifters of crop i in region j.

The function g is homogeneous of degree zero in prices, that is, multiplication of all independent variables by a constant K will alter the value of the function by a multiple of K^0. Mathematically,

$$g(P_{ij}, S_{ij}) = g(kP_{ij}, kS_{ij}) = k^0 g(P_{ij}, S_{ij}) \qquad (3.10)$$

Therefore, the value of the function is changed by a multiple of $K^0(= 1)$, thus making the function homogeneous of degree zero.

Most subsidies in the western Canadian grains economy are applied on a per unit of output. It is assumed that these production subsidies have no direct affect on producer prices. In other words, production subsidies cause supply to shift vertically downwords at each price-output combination by the amount of the subsidy. Production subsidies are, therefore, treated as exogenous supply shifters.

4. Wheat Production Response

In Canada, wheat acreage occupies more cultivated acreage than the total of all other cereals grown (62 percent).[12] Commodities produced on wheat farms in Canada consist of oats, barley, flax, and canola. This type of farm contains little and in most cases no livestock. The way in which wheat producers respond to price changes depends mainly upon the price expectation that is formulated at the time of seeding.

Variables and Units of Measurement

Approximately 90 percent of all wheat is marketed through the Canadian Wheat Board, therefore, C.W.B. payments are hypothesized to be the most influential factor in determining wheat production. Canadian Western Red Spring (CWRS) wheat represents a large proportion of that wheat marketed through the C.W.B., and therefore is used as the base crop in the wheat supply block. When measuring the price of wheat, any one of the following price series could be included in estimation:

1. The initial payment received from wheat sales prior to seeding.
2. Initial plus adjustment payments received by producers during a given crop year. This assumes producers are able to calculate these adjustment payments based upon initial payments and previous adjustment payments.
3. The final price received from the crop planted, which assumes that farmers are able to calculate final receipts on the basis of initial payments.
4. Total Board payments.
5. Canadian Wheat Board asking price for wheat.
6. Price received by producers delivering their wheat to the off-board market (feed grain price).
7. Average farm gate price for wheat.

---

[12] Statistics Canada.

The price structure of the domestic wheat market results in no definitive supply-inducing price, as producers respond to these different price series in various ways.

Kraker (1985) used the C.W.B. initial price less transportation and handling costs as the supply inducing price for wheat. This price merely reflects the elevator price which Kraker assumes to predominate all other producer prices.

Further, Schmitz (1968) in a study on Canadian wheat acreage response uses the latest final price (including the final payment) prior to seeding, whereas Schmitz and Bawden (1973) used the average farm price of wheat lagged one period. Capel (1968) used the March average C.W.B. International Wheat Agreement price for No. 2 Northern Wheat at Fort William, and Meilke (1976) used initial prices (lagged one production period) and final payments (lagged two production periods) as separate variables in explaining the variability in wheat acreages.

Spriggs (1981) and Sinner (*et. al.*, 1987) used off Board prices to reflect the supply-inducing price. In fact, Spriggs argues that the off Board price more closely reflects the supply - inducing price whether quotas are restrictive or not.

In estimating the wheat production equation, the basic structure of Kraker's wheat production model was adapted. Therefore, it is assumed that producers respond to initial prices less transportation costs. Elevator handling charges have the same magnitude at different points of production. This would shift the supply function upwards to the left at the same quantity combination as under farm gate returns specified as initial payments minus transportation costs. Therefore, no significant difference on the magnitudes and direction of production would result between the two definitions of prices.

Due to the geographical separation of the locational units used in the model, there is no consistent rule as to the competitive relationship that occurs between wheat, rapeseed (canola), or barley production. For example, in high animal producing areas, such as crop reporting districts 4,5, and 6 in Alberta, Manitoba, and 7 and 9 in Saskatchewan, canola has a tendency to be more competitve with barley than with wheat production. On the other hand, in areas which are susceptible to low moisture, i.e., areas 1-4 in Saskatchewan, and 1-3 in Alberta, little competitive relationship exists between the three crops. In these areas, wheat is the predominant crop and any residual land is planted either to barley or canola which is dependent upon many economic and environmental factors.

Apart from the geographic separation of the various producing areas, many grain producers, in order to maximize profits, would rather grow more wheat and canola than barley because of the higher returns per bushel. In a high animal producing area, a producer may maximize returns through animal production, therefore, more barley may be seeded in these areas. But, in low moisture areas, there tends to be no substitute crop for wheat.

One hypothesis that prevails in most supply responses is that large carryovers of on-farm stocks cause a reallocation of acreage away from a crop to other substitutable crops. It is assumed in this study that this behaviour will be captured in prices. It is also realized that producers would have a difficult time in calculating stock levels at the time of seeding.

It is hypothesized that producers, in formulating wheat production plans in period t, respond to quota levels. Therefore, the quota level in period (t+1), is an important variable since it indicates producers' marketing opportunities. Low quota levels would indicate marginal marketing opportunities through the C.W.B. The relative severity of the quota, as indicated by Sampson and Gerrard (1987), is not captured in any one year. For this reason, a quota index (from 0-5) was developed and lagged one production period. The eligible delivery rates are the sum of the year end rates (kilograms) set under the general, supplementary, and unit quota systems converted to bushels per acre. The quota index was specified as follows:

INDEX NUMBERS	SIZE OF QUOTA (BU./AC.)	DESCRIPTION
5	-	Open
4	30-50	High
3	16-29	Moderate-High
2	9-15	Moderate
1	0-8	Light

A dummy variable was included in the wheat production response to reflect the Federal Lower Inventories for Tomorrow (LIFT) Program. This program encouraged producers to set aside some of their wheat acreage plantings in 1970. In all sub regions during this program wheat production fell by almost 50 percent. Therefore, it is hypothesized that this program would have a negative effect on wheat production. This variable is a zero-one dummy variable having a value of one in 1970 and zero otherwise.

The wheat production response in general form consists of:

$$A_{w_i} = f_i(P_{w_i}, P_{c_i}, P_{b_i}, dum1, quota) \qquad i = 1, 2, \ldots 7 \qquad (3.11)$$

Where:

A_{w_i} = Wheat production in '000 of bushels in region i.

P_{w_i} = Farm gate price of wheat (\$/bu.) in region i.

P_{c_i} = Farm gate price of canola (\$/bu.) in region i.

P_{b_i} = Farm gate price of barley (\$/bu.) in region i.

$dum1$ - LIFT dummy, 1=1970, 0=otherwise.

$quota$ - Delivery rate, (bushels/acre)

5. Barley Production Response

Barley is the third most important crop, in terms of farm cash receipts, produced on farms in Canada today. Many barley farmers produce primarily for animal feed, especially in hog and beef production.

The off Board market for coarse grains is more important than for wheat, and therefore should be considered in a farmers' production determination process. In this study, in specifying barley prices, the C.W.B. and off Board market are assumed to be of equal importance. Kraker (1985) states that the C.W.B. price tends to set the floor for the off Board price. These two prices have a tendency to follow the same trends, which can be seen in Figure III.2. Therefore, the price to be used in the barley production response consists of the C.W.B. initial price, (\$/tonne). Farm gate prices in the barley response equation are calculated similarly for both the own price and prices of substitute and competitive crops, as in the wheat production response.

Wheat is considered to be a substitutable crop to barley (in major animal producing regions) in most of the sub regional barley production responses, although a small percentage of wheat in the domestic market has been diverted towards feeding purposes. In low moisture areas the level of wheat production tends to affect barley production, that is, a producer first makes a wheat planting decision then a barley and canola planting decision depending upon their remaining land base.

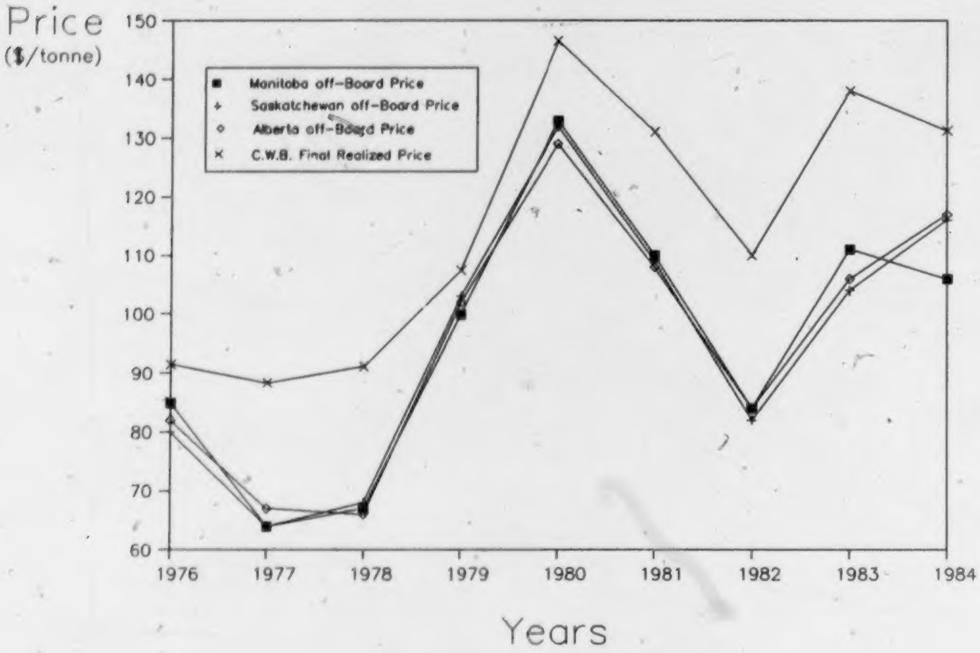


Figure III.2: Comparison of Barley Prices (1976-1984)

It is hypothesized that quota levels do not have an influence on barley planting decisions. This is mainly due to an alternative domestic feed grain barley market being available.

A dummy variable to reflect the effects of the LIFT program on barley production was included in each sub regional response function. This was also a zero-one dummy. This program affected producing sub regions differently. In most cases the LIFT program was short lived and its main objective was to diversify away from wheat production. A longer term impact occurred in barley production, which resulted in a substantial increase in barley output. The general production response for barley has the following form:

$$A_{b_i} = f_i(P_{w_i}, P_{c_i}, P_{b_i}, dum2) \qquad i = 1,2,\ldots 7 \qquad (3.12)$$

Where:

A_{b_i} = Barley production in '000 of bushels in region i.

P_{w_i} = Farm gate price of wheat ($/bu.) in region i.

P_{c_i} = Farm gate price of canola ($/bu.) in region i.

P_{b_i} = Farm gate price of barley ($/bu.) in region i.

$dum2$ = 0-1 dummy to represent the effects on barley production from the LIFT program.

6. Canola Production Response

Canola is not marketed through the Canadian Wheat Board. It is sold instead through the open market. Since canola moves through the same transportation and storage facilities as Board grains, deliveries to the primary elevator are controlled by quotas. It is hypothesized that quotas have a minor influence on producers decisions in planting canola, mainly because historically quotas have not been binding.

The level of canola production is hypothesized to be a function of farm gate prices of canola, wheat, and barley, and two dummy variables, one representing the after affects of the LIFT program and the second involving the change to low erucic acid and low glucoinrolate rapeseed varieties during the 1976-1978 crop years. Since the price of canola is not controlled by the C.W.B., the Winnipeg commodity exchange one year average future price ($/tonne) for the March delivery month is used as the supply-inducing price. The march future price was used to indicate the market opportunities for canola at the time of planting decisions. This price than is converted into a farm gate price by deducting the appropriate transportation charges. Farm gate prices for the cross price effects are calculated in the same manner as the other supply responses. Depending upon the region, the competing crop may be wheat, or barley.

Crop responses for canola consist of the following general form:

$$A_{c_i} = f_i(P_{w_i}, P_{c_i}, P_{b_i}, dum3, dum4) \qquad i = 1, 2, \ldots 7 \tag{3.13}$$

Where:

A_{c_i} = Canola production in '000 of bushels in region i.

P_{w_i} = Farm gate price of wheat ($/bu.) in region i.

P_{c_i} = Farm gate price of canola ($/bu.) in region i.

P_{b_i} = Farm gate price of barley ($/bu.) in region i.

$dum3$ = 0-1 dummy to represent the after affects of LIFT on canola production.

$dum4$ = 0-1 dummy to represent the change in varieties on canola production.

7. Demand Block

In order to be consistent with the supplies in the spatial equilibrium analysis, demand must represent derived demand. It would not be meaningful to intersect a market demand function with a farm supply function.

Demand in the barley market at the farm level consists of demand for on-farm feed use and export demand. Demand for on-farm feed use is primarily the feed grain requirements for livestock in a particular region. In order to measure aggregate feed grain requirements accurately, livestock inventories on farms as of July 1 were converted to a standard basis known as "grain consuming animal units" which indicate the annual grain requirements for each class of livestock. Basically the feed grain consuming factors are multiplied by the livestock inventory numbers in a particular region to determine feed grain requirements. The level of feed grain demand is assumed to be constant throughout each simulation year.[13]

Stocks of grain available for export at the farm gate are basically a function of total production minus feed grain requirements. This assumes that each sub region consumes its own product and exports the remainder. This is consistent with C.W.B. policies in the sense that producers receive the same initial and final payments for their crops no matter when it actually is sold during a crop year. In other words, the price in the excess demand regions (export ports) is the initial price and all producers face the same initial price, therefore, the annual sub regional export demand functions are perfectly elastic.

If the delivery quota, however, restricts marketings, any excess production must be applied against sales under quota in the next production period. Since the costs of holding inventories are incurred by the primary producer it would seem rational to produce and sell tomorrow rather than produce today, store and sell tomorrow at the expense of future production. Speculative purposes of holding stocks would only be profitable if expected prices were greater in period (t+1) and delivery quotas exceeded the productive capacity of the farm.

---

[13] Feed grain consumption varies over the simulation period, given different livestock regional inventories every production year.

In summary, total derived demand for barley is represented by a horizontal summation of feed use and export demand. This is represented in Figure III.3. In this diagram, OA represents the amount of feed grain requirements and is assumed constant throughout the production period. Exports are primarily a function of farm gate prices, and total summation results in a kinked demand function. In this study this function is moved along the supply function in order to determine the quantities available for export.

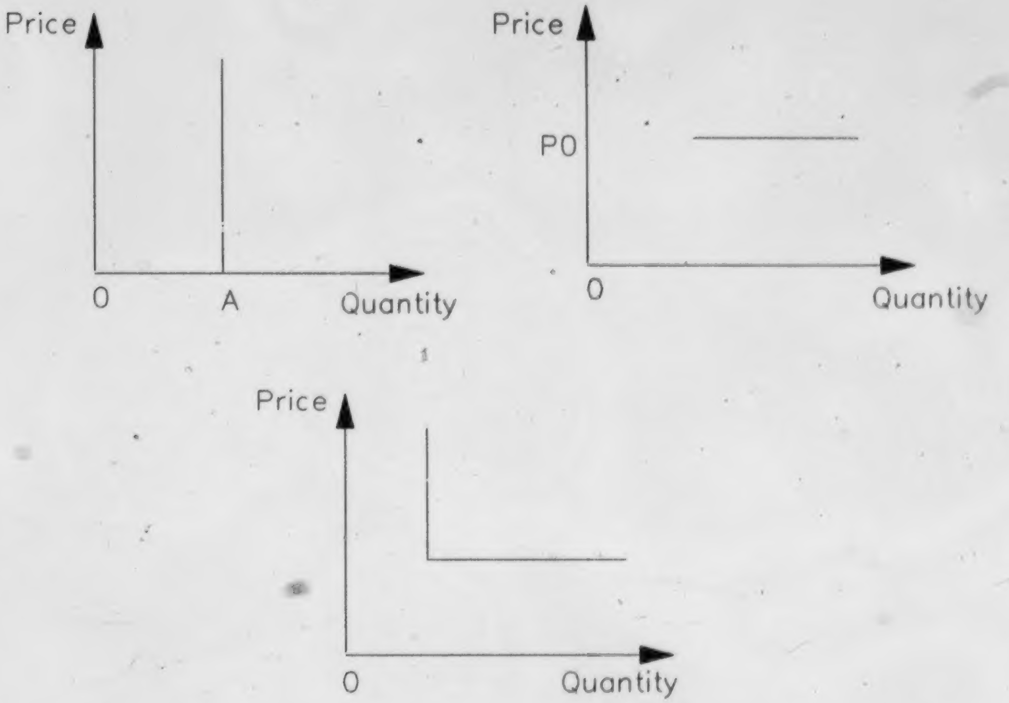


Figure III.3: Total Derived Demand for Barley

Derived demand for wheat consists primarily of quantities available for export and is represented by one point, total production. This tends to be consistent with the barley demand for exports at the farm level. It is assumed that no demand for wheat feed use on farms exists. This is realistic since only small amounts of wheat are diverted into the domestic market (17 percent of total production in 1984-1985, consisting of wheat for milling purposes as well as feed).

Canola producers who ship their product for export from Canada also employ the transportation cost advantage set under the Western Canadian Transportation Act. Derived export demand for canola, as with wheat, is specified to be a function of total canola produced.

8. Production Simulation Sub Model

The above specifications of supply represent the conceptual model that was estimated. The linking of the three different grains - canola, wheat, and barley - among the seven producing regions and the two export ports was then simulated. All supply equations were expressed in two dimensions, in order to simplify the simulation. The mathematical derivation of the two dimensional function consists of all variables collapsed into the intercept term except for the own price (slope of the equation). Mathematically these equations are as follows:

$$Q^s_{ij} = \alpha_{ij} + \beta_{ij} P^0_{ij} \qquad i = 1,2,\ldots 7; \; j = 1,2,\ldots 7 \qquad (3.14)$$

Where:

Q^s_{ij} = Equilibrium quantity supplied in the i^{th} region and j^{th} crop in time period t.

α_{ij} = All exogenous variables in the i^{th} region and j^{th} crop.

β_{ij} = Slope of the function for the i^{th} region and j^{th} crop.

P^0_{ij} = The equilibrium price for the i^{th} region and j^{th} crop in time period t.

Linking of all supply functions in the production simulation sub model occurred through cross prices or the intercept term in all two dimensional equations. In the baseline run actual prices and exogenous variables were inputted into the production simulation sub model. Following the baseline run a price policy change was implemented. New prices were than calculated. These new prices cause a shift and a movement along the supply function.

Statistical assumptions concerning the distribution of the disturbance term are necessary in order to specify a regression model.

$$Y_i = \beta_0 + \beta_1 X_i + U_i \qquad i = 1,\ldots,n \qquad (3.15)$$

Subject to:

1. $E(U_i) = 0$ for all i conditional disturbances.
2. $E(U_i^2) = \sigma^2$ for all i conditional disturbances, where σ^2 is a constant.
3. $E(U_iU_j) = 0$ for all i not equal to j.
4. Values of X are fixed in repeated sampling.

Assumption 1 ensures that the expected value, or mean, of each conditional distribution of U is zero. In the second assumption conditional distributions of U associated with different values of X have equivalent variances. The third assumption states that the disturbance terms are not correlated across the conditional distributions. This means that the value of each U_i is independent of all other values of U. The final assumption indicates that all X_i values are not correlated with the U_i values; that is, the X_i are independent of the U_i. Equation 3.15 plus assumptions 1 through 4 comprise the linear model under least square regression theory.[14]

A likely occurrence with the use of time series data is that successive disturbance terms in the equation being estimated are correlated. In this case, ordinary least squared procedures will not yield best linear, unbiased estimates because the $E(U_iU_j) = 0$ assumption is violated. When the equation is corrected for first order autocorrelation the predicted value (production) must include a correction factor. For example when the estimated equation has no autocorrelation the predicted value is calculated as follows:

$$\hat{Y}_{t+1} = \beta_0 + \beta_1 X_{t+1} \tag{3.16}$$

When disturbances become correlated the predicted value is calculated as follows:

$$\hat{Y}_{t+1} = \beta_{0t+1} + \beta_1 X_{t+1} + \rho(Y_t - (\beta_{0t} + \beta_1 X_t)) \tag{3.17}$$

Both general functions (3.16 and 3.17) are used in the production simulation to determine the predicted magnitudes of production.

Initially, prices and exogenous variables in each simulation year (1982-1987) were set at actual levels in order to test for predictability of the various functions and to determine the equilibrium levels in each sub region and for each commodity market. This is consistent with the theory of competitive pricing. In a competitive market, there can only be one price-quantity equilibrium point per unit of time. The validity of this latter statement depends upon the assumption that buyers and sellers have "perfect knowledge". This means that the price is known with certainty in all available markets. This is reasonable for the western Canadian grains economy since all producers know the level of initial prices and/or transportation costs of their product to market before planting decisions are made.

---

[14] Johnson, Aaron C., Marvin B. Johnson and Rueben C. Buse. *Econometrics Basic and Applied.* Macmillian Publishing Company, 1987.

Figure III.4 shows the initial equilibrium price and quantity relationship for barley in each sub region in western Canada. Equilibrium in the barley market occurs at a price P_0 , and a quantity equivalent to Q_0 , Producer surplus is represented by the shaded area. Consumer surplus is $+\infty$ sense there is no upper level on the amount consumers are willing to pay for barley. Sense consumer surplus measurement is defined as the area between the actual transaction price and the price consumers are willing to pay results, under a kinked demand function, being $+\infty$.

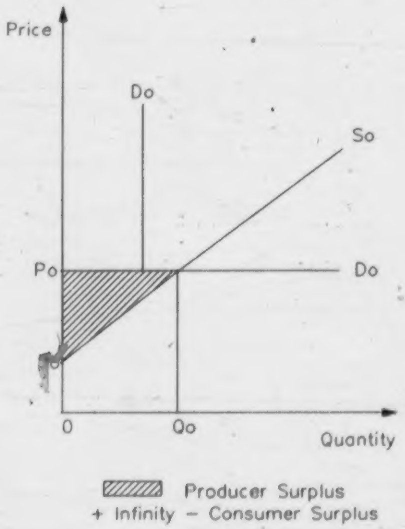


Figure III.4: Sub Regional Price Equilibrium - Barley

Figure III.5 shows price equilibrium in the wheat and canola market. This diagram differs from the barley market in that no domestic demand for wheat and canola are considered. The shaded area represents producer surplus. Prices that consumers are willing to pay for wheat and canola are equivalent to the actual transaction price. Consumer surplus in the canola and wheat market is equivalent to zero initially, due to the perfectly elastic demand function.

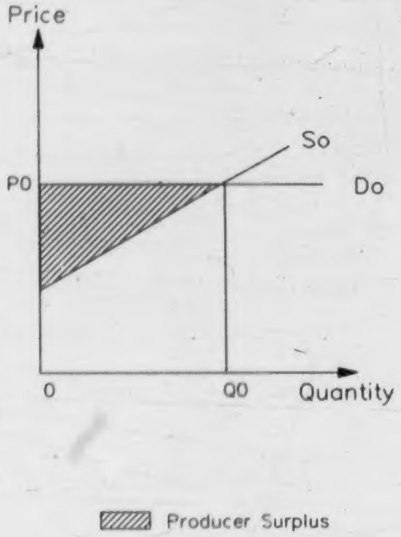


Figure III.5: Sub Regional Price Equilibrium - Wheat and Canola

Production constraints on each grain and oilseed crop in each sub region are included in the simulation model. Production constraints are set at levels equivalent to the maximum number of acres that historically have been seeded to a lead crop in each region multiplied by the maximum yield (Bu./Ac.) that has occurred for that crop in each sub region. The second part of the constraint involves multiplying the amount of acres that was seeded to the remaining crops by their respective yields (Bu./Ac.) in the same production year to determine the entire constraint. This represents the potential production opportunities in a particular region. Table III.2 illustrates these potential production opportunities on a sub regional basis that were used in the production simulation sub model. These production constraints remain static throughout the simulation model.

All collapsed supply functions are used to determine different equilibrium quantities (for wheat, barley, and canola) from performing different pricing policy options. By subtracting total sub regional domestic requirements in the barley market results in total available exports

TABLE IV.2: STATIC POTENTIAL PRODUCTION OPPORTUNITIES

BUSHELS

REGION	WHEAT	BARLEY	CANOLA
ALBERTA			
123	123,691	112,896	40,300
456	95,000	252,000	52,000
7	35,000	55,200	25,200
SASKATCHEWAN			
14	270,600	102,000	3,645
568	234,300	129,600	52,000
79	122,100	77,000	37,500
MANITOBA	180,000	46,400	39,000

from each location. Exports of wheat and canola from each sub region are equivalent to total production in each sub region. These quantities were then used in a transportation linear programming sub model. The following table illustrates these pricing options.

TABLE III.3: PROPOSED PRICING POLICY OPTIONS

EXPERIMENT	DESCRIPTION
1.	Existing C.W.B. policies on averaging grain prices. Baseline analysis.
2.	C.W.B. pricing proposal. Determining the impact on production and transport patterns if producers were to pay the lower of the St. Lawrence/Vancouver freight charge.
3.	New pricing alternatives. This involves determining if the Mississippi River alternative is an alternative route for western Canadian grains.
4.	Total cost pricing. This will determine the effects on grain production and flows if producers were to pay costs of shipping grain set under the W.G.T.A.
5.	Total cost pricing with the new C.W.B. proposal.

9. Transportation Sub Model

In the linear transportation sub model the total amount of product shipped from each region is viewed as total quantities available for export in each producing region. This method is used normatively to assess how the output of each sub-region "should" flow to the two export ports if competitive conditions are to be maintained. In this sense, this method is appropriate to analyze problems of comparative and interregional competition because of proposed changes in grain transportation policies.

West Coast (Vancouver, Prince Rupert) capacity constraints are also included in the transportation algorithm. To more closely simulate the production and marketing condition during each simulated crop period, actual shipment levels through the West Coast were assigned as spacified by the Canadian Grain Commission, (Table III.4).

TABLE IV.4: ACTUAL GRAIN SHIPMENTS VIA WEST COAST (1982-1987)

MILLIONS OF TONNES

CROP YEAR	SHIPMENTS VIA WEST COAST
1982-1983	11.30
1983-1984	11.70
1984-1985	10.00
1985-1986	12.00
1986-1987	15.70
1987-1988	13.40

It is realized that West Coast capacity levels could be as much as 20 million tonnes. To accommodate the increase in West Coast capacity over actual export shipments an additional linear programming least cost solution is obtained.

To express the transportation linear programming model mathematically,

let,

X_{wij} = Amount of wheat to be shipped from origin i to destination j.

X_{bij} = Amount of barley to be shipped from origin i to destination j.

X_{cij} = Amount of canola to be shipped from origin i to destination j.

X_{oij} = Amount of oats to be shipped from origin i to destination j.

C_{wij} = C.W.B. and Producer costs of shipping a tonne of wheat from origin i to destination j.

C_{bij} = C.W.B. and Producer costs of shipping a tonne of barley from origin i to destination j.

C_{cij} = C.W.B. and producer costs of shipping a tonne of canola from origin i to destination j.

C_{oij} = C.W.B. and producer costs of shipping a tonne of oats from origin i to destination j.

θ_i = Total availability of crops at origin i.

such that:

$$Z_{\min} = \sum_{i=1}^{7}\sum_{j=1}^{3} C_{wij}X_{wij} + \sum_{i=1}^{7}\sum_{j=1}^{3} C_{bij}X_{bij} + \sum_{i=1}^{7}\sum_{j=1}^{3} C_{cij}X_{cij} + \sum_{i=1}^{7}\sum_{j=1}^{3} C_{oij}X_{oij} \qquad (3.18)$$

Subject to:

$$X_w + X_b + X_c + X_o = \sum\theta = \mathit{Total\ Exports} \qquad (3.19)$$

$$\sum X_{wi} + \sum X_{bi} + \sum X_{ci} + \sum X_{oi} \leq \text{Assigned West Coast shipments } (j=1) \qquad (3.20)$$

$$X_{wj} + X_{bj} + X_{oj} = \text{Amount Shipped Via East Coast } (j=2) \qquad (3.21)$$

$$X_{wj} + X_{bj} + X_{oj} = \text{Amount Shipped Via the Mississippi } (j=3) \qquad (3.22)$$

Equation (3.19) ensures that the total amount shipped from each region will be equal to what is available for export in that region. Equation (3.20) represents a capacity constraint on West Coast shipments. In equations (3.21 and 3.22) shipments through Thunder Bay and the Mississippi River are not constrained. Therefore all grain may flow through these two ports if it represents a feasible least cost solution.

Since supply responses are taken account of outside the linear transportation model, the limiting assumption of fixed demand and supply becomes somewhat less limiting in this model. Also, the assumption of proportionality between resource use and each activity is realistic in the western Canadian grains economy. In this sector, under W.G.T.A., costs of shipping grain remain constant per tonne over the total quantity shipped during a specific crop year.

The main difference between the linear transportation model and a quadratic programming model previously discussed is the objective function. The quadratic programming model will maximize or minimize a polynomial to the second degree. In other words, in a quadratic programming framework total welfare is maximized in each sub region. First round effects (before cost savings/increases) in the grain redistribution model result in total welfare being a positive instead of a normative measure, but total shipment costs are optimized. Changing producer prices by the amount of cost savings/increases results in producer welfare being a normative measurement. If producers in each region allocate resources optimally, no significant difference could be found between the grain redistribution model and a quadratic programming framework. In fact, the grain redistribution model allows more flexibility in determining net cost savings and impacts on shipment patterns than would a quadratic programming model.

10. Cost Analysis

After application of the transportation sub model, optimal grain shipments are used to determine total freight costs. These costs are broken down into three categories, producer costs, C.W.B. costs, government costs, and total system costs. These cost components are determined for each sub region in the analysis and are also aggregated on a provincial basis. This analysis calculates and compares the total costs of shipments for each crop under the baseline analysis and each policy option. Cost savings and/or increases are determined by comparing the baseline to a particular policy option for each component. C.W.B. cost savings and/or increases are incurred by the pool account for each specific crop. Any cost savings or increases associated with the C.W.B. are then included in the production simulation model through prices to determine the final adjustment in production and shipment patterns. It is assumed that the C.W.B. would be able to calculate these cost savings prior to announcing initial payments in March.

11. Welfare Effects

After the final adjustment (production) an assessment of welfare effects from each pricing policy are calculated from the sub regional supply responses. For example, Figure III.6 illustrates the impact when wheat and barley prices increase in the barley market. In diagram (a), an increase in barley prices causes the export demand function to increase from D0 to D1. But, a increase in both wheat and barley prices cause the supply function to shift from S0 to S1. This function will shift because wheat price is a supply shifter and is includded in the intercept term. With a increase in the own price (barley) a movement along the function would also result. The shaded area represents the change in consumer surplus (increasd cost to livestock producers). Producer surplus is equivalent to the shaded area in Figure III.4. In diagram (b) the shaded area represents the new producer surplus because of the change in prices. Diagram (c), on the other hand, represents the change in producer surplus calculated as the difference in Figure III.4 and Figure III.6(b). The final diagram in Figure III.6 represents the net welfare gain (loss) for each region because of the policy change. By adding the shaded area in (a) and (c), one can determine the net welfare gain (loss) because of a change in grain policies.

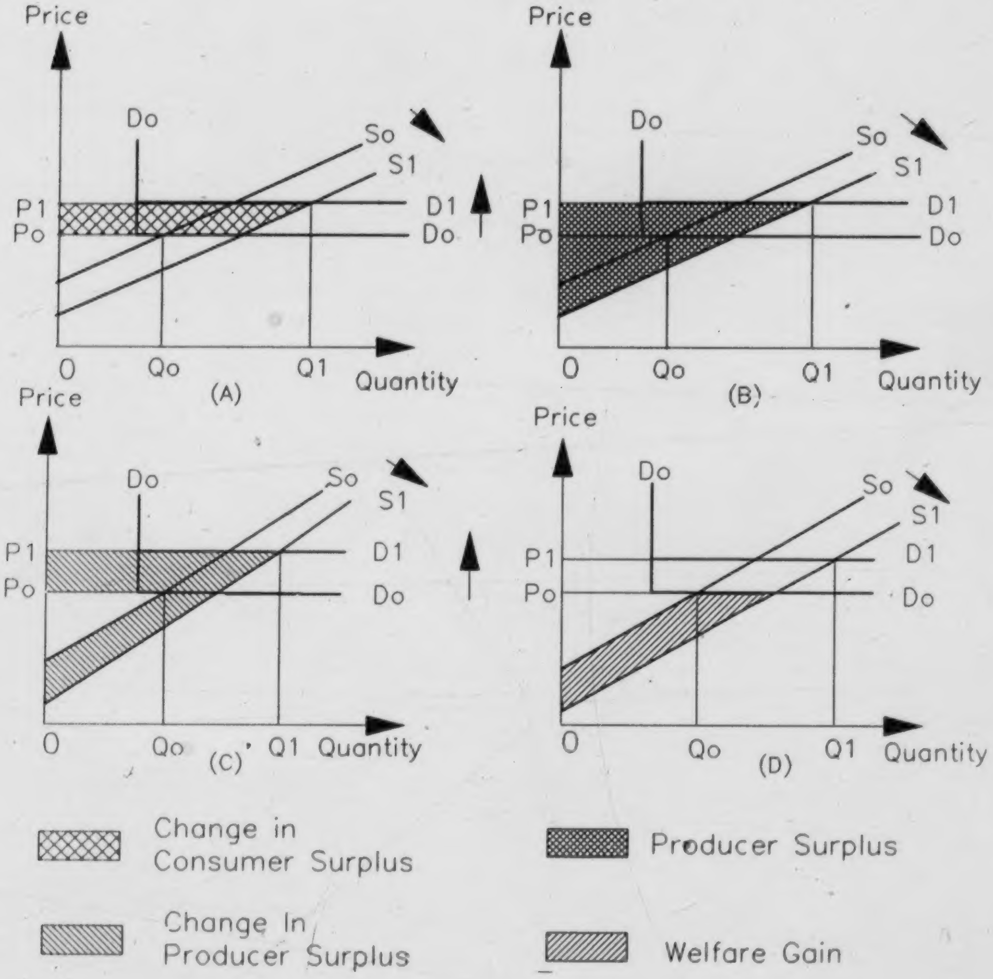

Price
Do
So
S1
P1
Po
D1
Do
0
Qo
Q1
Quantity
(A)
Price
Do
So
S1
P1
Po
D1
Do
0
Qo
Q1
Quantity
(B)
Price
Do
So
S1
P1
Po
D1
Do
0
Qo
Q1
Quantity
(C)
Price
Do
So
S1
P1
Po
D1
Do
0
Qo
Q1
Quantity
(D)
Change in Consumer Surplus
Producer Surplus
Change In Producer Surplus
Welfare Gain

Figure III.6: Welfare Effects in the Barley Market

In the case of an increase (decrease) in canola and wheat demand, the change in consumer surplus does not represent the increase (decrease) in feeding costs, but the increase (decrease) costs to foreign consumers for these commodities.

IV BASELINE ANALYSIS

A. Production Results Under Current Freight Rates to Producers (1982-1987)

A baseline scenario was developed to simulate 1982 through 1987 crop production from the estimated supply responses (Table IV.1). Producer welfare and price elasticities are also calculated from these supply responses. All crop specifications had a tendency to be price inelastic. [15] If supply is inelastic, a given fall in price causes a small change in production. Exceptions to the above conditions were due mainly to climatic conditions in the region, that is, some regions becoming crop specific.[16]

TABLE IV.1: BASELINE PREDICTED CROP PRODUCTION (1982-1987)

('000 TONNES)

CROP YEAR

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
ALBERTA						
Barley	5932.40	4767.29	5285.85	5231.96	5479.33	3726.05
Wheat	5966.46	4344.34	5086.37	3444.30	5573.45	3597.46
Canola	981.93	1338.00	1162.37	1163.27	957.84	1251.24
SASKATCHEWAN						
Barley	3667.8	2603.56	3042.22	3279.48	2404.58	2077.91
Wheat	13816.2	10459.8	11593.4	9586.66	14018.6	9963.42
Canola	851.01	1441.85	1217.69	1386.41	920.88	1413.53
MANITOBA						
Barley	2035.13	1998.83	2109.65	2140.74	1489.94	1382.57
Wheat	3713.65	3250.63	3656.84	3762.98	3713.06	3200.33
Canola	416.48	540.88	473.96	565.83	393.37	574.68
PRAIRIES						
Total	37381.1	30745.2	33628.35	30561.63	34951.05	27187.19

---

[15] These supply elasticities include both own and cross price elasticities. This indicates a producers total response to price changes.

[16] The results of all supply functions and validation of the various relationships are in Appendix A, Tables A-1 through A-21.

During the simulated period (1982-1987), estimated prairie grain production in terms of volume consisted of approximately 27 to 37 million tonnes. This total grain production consists predominately of wheat and canola in Saskatchewan, barley and canola in Alberta and to a lesser extent wheat in Manitoba.[17]

TABLE IV.2: ABSOLUTE PERCENT ERROR IN CROP PRODUCTION (1982-1987)

PERCENT

CROP YEAR

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
ALBERTA						
Barley	16.40	3.00	11.00	30.00	1.42	32.90
Wheat	2.4	0.80	15.10	46.00	10.4	31.50
Canola	8.00	1.70	6.80	30.00	32.80	14.00
Total	5.8	0.80	10.20	36.00	1.00	30.00
SASKATCHEWAN						
Barley	21.00	6.00	16.00	18.00	28.00	35.80
Wheat	6.00	8.90	6.00	36.00	18.20	20.30
Canola	20.00	0.91	21.00	7.00	38.70	7.00
Total	7.00	7.3	2.90	29.70	1.70	22.00
MANITOBA						
Barley	21.90	3.00	19.72	17.98	49.58	38.00
Wheat	12.05	9.27	33.98	30.20	12.24	26.00
Canola	4.7	0.64	33.99	12.24	51.47	9.00
Total	17.90	3.50	22.20	19.30	21.10	28.50
PRAIRIES						
Grand Total	7.70	2.80	3.30	29.90	3.70	26.20

Table IV.2 illustrates the absolute percent error of calculated production levels over actual levels on a provincial basis. This percent error varies from a low of 0.64 percent (1983-1984 crop year) to a high of 51 percent (1986-1987 crop year), in Manitoba for canola production. The range in the overall error in predicting grain production for each province varied between 0.80 and 36 percent.[18] The absolute percent error for total crop production in western Canada ranged from 2.8 to 29.9 percent. This indicates the performance level of all supply functions to be reliable in predicting the direction of change in grain production given specific policy changes over the simulated period. It should be noted that the estimated supply functions ignore any weather or climatic factors in each sub region within western Canada. The quantities predicted from these functions merely represent total product that would be produced at specific prices and average yields.

---

[17] Grain production on a sub-regional level is in Appendix A, Table A-22.

[18] Absolut percent error calculations for all sub regional supply functions are in Appendix A, Table A-23, over the simulated period, (1982-1987).

Table IV.3 indicates the level of estimated producer surplus on a provincial basis during the simulated period. Wheat production tends to contribute the greatest to final producer welfare. Overall producer welfare in western Canada was estimated to vary between 1.50 and 3.70 billion dollars or $53.39/tonne to $120.57/tonne.

TABLE IV.3: BASELINE PRODUCER SURPLUS (1982-1987)

('000 DOLLARS)

CROP YEAR

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
ALBERTA						
Barley	256649	171299	206632	199493	172812	63864
Wheat	521143	486184	435322	360467	358777	228827
Canola	103222	221596	172149	187721	101474	190402
SASKATCHEWAN						
Barley	188634	140803	183499	195557	92621	59919
Wheat	912229	761879	692735	608891	692156	389364
Canola	169571	379052	299677	368339	137598	276501
MANITOBA						
Barley	76880	56199	73467	75328	39493	24521
Wheat	255450	217437	253002	303184	229578	181113
Canola	37264	72610	60229	105537	41494	94635
PRAIRIES						
Total	2521042	2507059	2376710	2404517	1866002	1509146

B. Estimated Grain Transportation Patterns (1982-1987)

Estimated production levels less quantity demanded locally represent applicable quantities. These applicable quantities are used in a least cost transportation sub model to determine the flow of commodities, wheat, barley, canola, and oats, to the two export positions, and final transport costs incurred by primary producers and the C.W.B. Two optimal solutions are obtained for each simulated crop year, one using the actual production and marketing condition as a constraint through West Coast ports and the other using a 20 million tonne restriction at Vancouver and/or Prince Rupert (Table IV.4 and IV.5).

TABLE IV.4: BASELINE GRAIN FLOWS (1982-1987)

Millions of Tonnes

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
11.3 MILLION TONNE WEST COAST CONSTRAINT (1982-1983)						
WEST COAST						
ALBERTA	0.73	5.03	0.98	-	6.74	55.34
SASKATCHEWAN	-	2.69	0.85	-	3.54	20.31
MANITOBA	-	0.60	0.42	-	1.02	40.32
TOTAL	0.73	8.32	2.25	-	11.30	32.35
EAST COAST						
ALBERTA	5.24	-	-	0.20	5.44	44.66
SASKATCHEWAN	13.82	-	-	0.07	13.89	79.69
MANITOBA	3.71	0.72	-	0.07	4.50	59.68
TOTAL	22.77	0.72	-	0.34	23.63	67.65
11.7 MILLIO TONNE WEST COAST CONSTRAINT (1983-1984)						
WEST COAST						
ALBERTA	1.18	3.87	1.34	-	6.39	66.34
SASKATCHEWAN	-	2.09	1.44	-	3.53	25.07
MANITOBA	-	1.24	0.54	-	1.78	35.04
TOTAL	1.18	7.20	3.32	-	11.70	40.43
EAST COAST						
ALBERTA	3.16	-	-	0.23	3.39	34.66
SASKATCHEWAN	10.46	-	-	0.09	10.55	74.93
MANITOBA	3.25	-	-	0.05	3.30	64.96
TOTAL	16.87	-	-	0.37	17.24	59.57
10 MILLION TONNE WEST COAST CONSTRAINT (1984-1985)						
WEST COAST						
ALBERTA	0.60	4.24	1.16	-	6.00	56.23
SASKATCHEWAN	-	2.30	1.22	-	3.52	22.52
MANITOBA	-	-	0.47	-	0.47	8.39
TOTAL	0.60	6.54	2.85	-	10.00	31.34
EAST COAST						
ALBERTA	4.48	-	-	0.19	4.67	43.77
SASKATCHEWAN	11.59	0.48	-	0.04	12.11	77.48
MANITOBA	3.66	1.41	-	0.06	5.13	91.61
TOTAL	19.73	1.89	-	0.29	21.91	68.66

...Continued

TABLE IV.4: con't BASELINE GRAIN FLOWS (1982-1987)

Millions of Tonnes

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
12 MILLION TONNE WEST COAST CONSTRAINT (1985-1986)						
WEST COAST						
ALBERTA	0.45	4.17	1.16	-	5.78	64.73
SASKATCHEWAN	-	3.03	1.39	-	4.42	31.41
MANITOBA	-	1.24	0.57	-	1.81	31.05
TOTAL	0.45	8.44	3.12	-	12.00	41.64
EAST COAST						
ALBERTA	3.00	-	-	0.15	3.15	35.27
SASKATCHEWAN	9.59	-	-	0.06	9.65	68.59
MANTOBA	3.76	0.19	-	0.07	4.02	68.95
TOTAL	16.35	0.19	-	0.28	16.82	58.36
15.7 MILLION TONNE WEST COAST CONSTRAINT (1986-1987)						
WEST COAST						
ALBERTA	5.57	4.50	0.96	-	11.03	98.13
SASKATCHEWAN	0.76	1.86	0.92	-	3.54	21.00
MANITOBA	-	0.77	0.39	-	1.16	23.82
TOTAL	6.33	7.13	2.27	-	15.73	47.71
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	1.87
SASKATCHEWAN	13.25	-	-	0.07	13.32	79.00
MANITOBA	3.71	-	-	3.71	3.71	76.18
TOTAL	16.96	-	-	3.99	17.24	52.29
13.4 MILLION TONNE WEST COAST CONSTRAINT (1987-1988)						
WEST COAST						
ALBERTA	3.60	2.75	1.25	-	7.60	97.31
SASKATCHEWAN	1.62	1.53	1.41	-	4.56	35.16
MANITOBA	-	0.66	0.57	-	1.23	27.33
TOTAL	5.22	4.94	3.23	-	13.40	52.99
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	2.69
SASKATCHEWAN	8.34	-	-	0.07	8.41	64.84
MANITOBA	3.20	-	-	0.07	3.27	72.67
TOTAL	11.54	-	-	0.35	11.89	47.01

TABLE V.5: GRAIN FLOWS WITH INCREASED CAPACITY

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
1982-1983						
WEST COAST						
ALBERTA	5.97	5.03	0.98	-	11.98	98.36
SASKATCHEWAN	2.74	2.69	0.85	-	6.28	36.03
MANITOBA	-	1.32	0.41	-	1.73	31.40
TOTAL	8.71	9.04	2.24	-	20.00	56.93
EAST COAST						
ALBERTA	-	-	-	0.20	0.20	1.64
SASKATCHEWAN	11.08	-	-	0.07	11.15	63.97
MANITOBA	3.71	-	-	0.07	3.78	68.60
TOTAL	14.79	-	-	0.34	15.13	43.07
1983-1984						
WEST COAST						
ALBERTA	4.34	3.87	1.34	-	9.55	97.65
SASKATCHEWAN	5.14	2.09	1.44	-	8.67	61.58
MANITOBA	-	1.24	0.54	-	1.78	35.04
TOTAL	9.48	7.20	3.32	-	20.00	69.11
EAST COAST						
ALBERTA	-	-	-	0.23	0.23	2.35
SASKATCHEWAN	5.32	-	-	0.09	5.41	38.42
MANITOBA	3.25	-	-	0.05	3.30	64.96
TOTAL	8.57	-	-	0.37	8.94	30.89
1984-1985						
WEST COAST						
ALBERTA	5.09	4.24	1.16	-	10.49	98.22
SASKATCHEWAN	5.03	2.79	1.22	-	9.04	57.80
MANITOBA	-	-	0.47	-	0.47	8.39
TOTAL	10.12	7.03	2.85	-	20.00	62.66
EAST COAST						
ALBERTA	-	-	-	0.19	0.19	1.78
SASKATCHEWAN	6.56	-	-	0.04	6.60	42.20
MANITOBA	3.66	1.41	-	0.06	5.13	91.61
TOTAL	10.22	1.41	-	0.29	11.92	37.34

...Continued

Results of the baseline scenario when actual marketing and production conditions represent West Coast capacity indicate approximately 31 to 53 percent of western Canadian grain being shipped through Vancouver and/or Prince Rupert ports (Table IV.4). Not surprising, the bulk of these grain shipments (primarily barley and canola) flow from the province of Alberta. Commodities handled at the eastern port (Thunder Bay), include wheat and oats, shipped from the three prairie provinces, during the simulated period, 1982 through 1987. In total, approximately 25.29 to 34.93 million tonnes of grain would be exported from western Canada during the simulated

TABLE V.5: con't GRAIN FLOWS WITH INCREASED CAPACITY

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
1985-1986						
WEST COAST						
ALBERTA	3.44	4.17	1.16	-	8.77	98.32
SASKATCHEWAN	4.78	3.03	1.39	0.04	9.24	65.67
MANITOBA	-	1.43	0.57	-	2.00	34.31
TOTAL	8.22	8.63	3.12	0.04	20.00	69.43
EAST COAST						
ALBERTA	-	-	-	0.15	0.15	1.68
SASKATCHEWAN	4.81	-	-	0.02	4.83	34.33
MANITOBA	3.76	-	-	0.07	3.83	65.69
TOTAL	8.57	-	-	0.24	8.81	30.57
1986-1987						
WEST COAST						
ALBERTA	5.58	4.50	0.96	-	11.04	98.13
SASKATCHEWAN	5.06	1.86	0.92	-	7.81	46.41
MANITOBA	-	0.77	0.39	-	1.16	23.48
TOTAL	10.64	7.13	2.27	-	20.00	60.59
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	1.87
SASKATCHEWAN	8.95	-	-	0.07	9.02	53.59
MANITOBA	3.71	-	-	0.07	3.78	76.52
TOTAL	12.66	-	-	0.35	13.01	39.41
1987-1988						
WEST COAST						
ALBERTA	3.60	2.75	1.25	-	7.60	97.31
SASKATCHEWAN	8.22	1.53	1.41	-	11.16	85.94
MANITOBA	-	0.66	0.57	-	1.23	27.33
TOTAL	11.82	4.94	3.23	-	20.00	79.08
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	2.69
SASKATCHEWAN	1.74	-	-	0.07	1.81	14.06
MANITOBA	3.20	-	-	0.07	3.27	72.67
TOTAL	4.94	-	-	0.35	5.29	20.92

period. The Federal Government commitment towards grain shipments is based on 31.5 million tonnes of grain. Although in some simulated years estimated export volumes exceed 31.5 million tonnes, producer freight rates would not reflect the additional tonnages exported. The reason for this is that the government has a tally adjustment mechanism. Instead of carrying any adjustments forward, a cummulative tally is used, so that the change in the rate each year reflects only inflation and long term (trend line) growth in volume.

An increase in West Coast capacity to 20 million tonnes over the simulation period (1983-1987), results in approximately 12.88 to 31.32 percent more grain shipments at Vancouver and/or Prince Rupert ports (Table V.5). The source in increased throughput at West Coast ports under a 20 million tonne constraint consists of wheat shipments from the provinces of Alberta and Saskatchewan.

C. Estimated Grain Transport Costs (1982-1987)

Tables IV.6 and IV.7 provide baseline grain shipping costs on a provincial basis during the 1982 through 1987 crop years.[19] These costs are divided among the producer, the C.W.B., and the government. Federal government costs towards total shipments are zero during the 1982 crop year because this program began Jan 1, 1984.[20]

Total logistic costs of shipments based on production responses range from $626.88 million or $17.88/tonne to $1.4 billion or $42.18/tonne when actual production and marketing conditions represent West Coast capacity. Producer costs from all grain shipments were estimated to be 152 to 233 million dollars during the 1982 through 1987 simulated period. The greatest proportion of these producer costs under actual marketing and production conditions at West Coast ports are from wheat shipments. With Saskatchewan producing the largest proportion of prairie wheat production and least cost shipment patterns through Thunder Bay, these cause the C.W.B. to pay a large proportion of these shipment costs ($208 million to $302 million). On average, the C.W.B. pays approximately $406 million dollars on all grain shipments as a result of estimated transport patterns with current marketing and production conditions at West Coast ports.

---

[19] Grain shipping costs to the C.W.B. on a sub regional basis are in Appendix A, Table A-24.

[20] This program (W.G.T.A.) is considered to be the basis from which transportation costs are calculated. Therefore, the government's contribution towards rail line rehabilitation is ignored in this analysis.

TABLE IV.6: BASELINE GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY.					
1982-1983					
Producer					
Wheat	28.93	65.38	13.11	107.41	4.57
Barley	24.31	13.06	4.67	42.04	4.65
Canola	4.76	4.40	2.94	12.09	5.38
Oats	0.96	0.32	0.23	1.52	4.54
Total	58.95	83.16	20.95	163.06	4.65
C.W.B.					
Wheat	104.72	263.89	70.93	439.54	18.71
Barley	-	1.11	19.28	20.40	2.26
Oats	2.42	0.74	0.72	3.88	11.60
Total	107.15	265.74	90.93	463.82	13.23
System					
Wheat	133.65	329.27	84.04	546.95	23.28
Barley	24.31	14.18	23.96	62.44	6.90
Canola	4.76	4.40	2.94	12.09	5.38
Oats	3.39	1.06	0.95	5.40	16.14
Grand Total	166.10	348.90	111.88	626.88	17.88

...Continued

TABLE IV.6: con't BASELINE GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY.					
1983-1984					
Producer					
Wheat	23.32	56.64	12.91	92.86	5.14
Barley	20.34	11.85	4.92	37.11	5.16
Canola	7.12	8.95	4.16	20.23	6.09
Oats	1.18	0.49	0.20	1.87	5.14
Total	51.96	77.93	22.18	152.07	5.27
C.W.B.					
Wheat	63.63	208.18	64.62	336.43	18.63
Barley	-	1.34	4.61	5.95	0.83
Oats	3.47	1.26	0.73	5.45	15.01
Total	67.09	210.78	69.96	347.83	12.04
Gov't					
Wheat	90.81	192.60	47.04	330.45	18.30
Barley	69.85	43.39	33.93	147.16	20.45
Canola	24.43	29.47	14.82	68.72	20.69
Oats	5.33	1.65	0.73	7.71	21.22
Total	190.41	267.10	96.53	554.04	19.18
System					
Wheat	177.76	457.42	124.56	759.74	42.08
Barley	90.19	56.58	43.46	190.22	26.44
Canola	31.55	38.42	18.98	88.95	26.78
Oats	9.97	3.40	1.66	15.03	41.37
Grand Total	309.46	555.81	188.67	1053.94	36.49

...Continued

TABLE IV.6: con't BASELINE GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY					
1984-1985					
Producer					
Wheat	37.66	87.21	21.65	146.52	7.20
Barley	31.28	21.35	8.34	60.96	7.23
Canola	8.58	10.18	5.31	24.07	8.43
Oats	1.37	0.30	0.33	2.01	7.10
Total	78.89	119.04	35.63	233.55	7.33
C.W.B.					
Wheat	105.88	255.38	80.45	441.70	21.72
Barley	-	14.17	36.61	50.77	6.02
Oats	3.31	0.61	0.87	4.79	16.96
Total	109.19	270.15	117.92	497.27	15.61
Gov't					
Wheat	105.04	203.31	49.55	359.90	17.70
Barley	71.82	52.68	19.08	143.58	17.02
Canola	19.72	23.31	12.16	55.19	19.34
Oats	4.11	0.71	0.76	5.59	19.76
Total	200.69	282.01	5.59	564.24	17.71
System					
Wheat	248.58	547.89	151.65	948.12	46.62
Barley	103.10	88.19	64.02	255.31	30.27
Canola	28.30	33.49	17.47	79.26	27.77
Oats	8.80	1.62	1.96	12.37	43.82
Grand Total	388.77	671.20	235.09	1295.06	40.66

...Continued

TABLE IV.6: con't BASELINE GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY					
1985-1986					
Producer					
Wheat	19.90	56.04	17.18	93.12	5.56
Barley	24.06	18.02	6.59	48.66	5.64
Canola	6.72	9.03	4.94	20.69	6.64
Oats	0.87	0.33	0.35	1.54	5.45
Total	51.55	83.41	29.22	164.18	5.71
C.W.B.					
Wheat	78.84	240.04	94.15	412.14	24.59
Barley	-	2.21	11.00	13.21	1.53
Oats	2.68	0.90	1.19	4.78	16.88
Total	81.53	243.15	106.34	431.01	15.00
Gov't					
Wheat	87.26	206.58	63.78	357.62	21.29
Barley	88.38	74.29	43.00	205.67	23.85
Canola	26.49	33.16	18.15	76.00	24.69
Oats	4.11	1.21	1.27	6.59	23.29
Total	204.43	315.25	126.20	645.88	22.47
System					
Wheat	186.00	502.66	175.28	863.94	51.44
Barley	112.43	94.52	60.58	267.54	31.02
Canola	31.41	42.19	23.09	96.69	31.03
Oats	7.66	2.44	2.81	12.91	45.62
Grand Total	337.50	641.81	261.76	1241.07	43.18

...Continued

TABLE IV.6: con't BASELINE GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY					
1986-1987					
Producer					
Wheat	32.08	81.31	17.41	130.81	5.61
Barley	25.90	11.07	3.61	40.59	5.70
Canola	5.52	5.69	3.42	14.63	6.54
Oats	1.21	0.41	0.31	1.93	5.56
Total	64.72	98.48	1.93	187.95	5.70
C.W.B.					
Wheat	-	302.29	84.62	386.91	16.60
Barley	-	1.15	3.08	4.23	0.59
Oats	3.87	1.16	1.08	6.11	17.64
Total	3.87	304.60	88.79	397.26	12.06
Gov't					
Wheat	134.20	340.88	71.33	546.41	23.45
Barley	108.32	51.13	28.00	187.45	26.31
Canola	23.08	23.77	14.30	61.15	27.34
Oats	6.57	1.72	1.26	9.54	27.52
Total	272.17	417.49	114.89	804.55	24.42
System					
Wheat	166.28	724.48	173.36	1064.13	45.66
Barley	134.23	63.36	34.70	232.28	32.60
Canola	28.60	29.46	17.72	75.77	33.88
Oats	11.66	3.28	2.65	17.58	50.72
Grand Total	340.76	820.57	17.58	1389.76	42.18

...Continued

An increase in West Coast capacity results in a 20 million tonne binding constraint at both Vancouver and/or Prince Rupert. Total shipping costs would decrease from $455 to $1.4 billion or $12.98/tonne to $42.18/tonne as a result of the increase in total throughput at West Coast ports. A comparison of per tonne shipping costs under current marketing and production conditions over the simulated period to a 20 million tonne West Coast capacity constraint, an increase of approximately $2.75/tonne to $7.64/tonne in shipping costs results to the Canadian grains industry under competitive conditions.

TABLE IV.6: con't BASELINE GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY					
1987-1988					
Producer					
Wheat	21.95	61.19	15.59	98.72	5.89
Barley	16.74	9.72	3.23	29.69	6.01
Canola	7.69	9.67	5.30	22.66	7.00
Oats	1.29	0.43	0.32	2.04	5.88
Total	47.67	81.00	24.43	153.10	6.07
C.W.B.					
Wheat	-	209.11	80.23	289.35	17.26
Barley	-	0.93	2.88	3.81	0.77
Oats	4.24	1.27	1.19	6.70	19.34
Total	4.24	211.31	84.31	299.86	11.89
Gov't					
Wheat	83.53	233.27	59.37	376.17	23.44
Barley	63.69	40.57	23.28	127.50	25.81
Canola	29.28	36.80	20.18	86.27	26.63
Oats	6.35	1.66	1.21	9.22	26.59
Total	182.85	312.25	104.05	599.14	23.76
System					
Wheat	105.48	503.57	155.18	764.23	45.60
Barley	80.43	51.16	29.40	160.99	32.60
Canola	36.98	46.47	25.48	108.93	33.62
Oats	11.87	3.36	2.72	17.96	51.81
Grand Total	234.76	604.56	212.78	1052.10	41.72

A 20 million tonne constraint at Vancouver and/or Prince Rupert, results in producer costs remaining the same when compared to the scenario of actual production and marketing conditions at West Coast ports. Canadian Wheat Board transportation charges on average decline to $236 million under a 20 million tonne throughput at West Coast ports. The C.W.B. continues to pay a large prorportion of Saskatchewan's grain shipment costs, when compared to total Board shipment costs in the provinces of Manitoba and Alberta.

TABLE IV.7: INCREASED CAPACITY - TRANSPORT COSTS (1982-1987) MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
1982-1983					
C.W.B.					
Wheat	-	211.58	70.93	282.51	12.02
Barley	-	1.11	4.66	5.77	0.64
Oats	2.42	0.74	0.72	3.88	11.60
Total	2.42	213.43	76.31	292.16	8.33
System					
Wheat	28.93	276.95	84.04	389.92	16.59
Barley	24.31	14.18	9.33	47.81	5.29
Canola	4.76	4.40	2.94	12.09	5.38
Oats	3.39	1.06	0.95	5.40	16.14
Grand Total	61.38	296.59	5.40	455.22	12.98
1983-1984					
C.W.B.					
Wheat	-	107.86	64.62	172.49	9.55
Barley	-	1.34	4.61	5.95	0.83
Oats	3.47	1.26	0.73	5.45	15.01
Total	3.47	110.46	69.96	183.89	6.37
Gov't					
Wheat	78.82	198.73	47.04	324.58	17.98
Barley	69.85	43.39	33.93	147.16	20.45
Canola	24.43	29.47	14.82	68.72	20.69
Oats	5.33	1.65	0.73	7.71	21.22
Total	178.42	273.23	96.53	548.17	18.98
System					
Wheat	102.14	363.23	124.56	589.93	32.67
Barley	90.19	56.58	43.46	190.22	26.44
Canola	31.55	38.42	18.98	88.95	26.78
Oats	9.97	3.40	1.66	15.03	41.37
Grand Total	233.84	461.62	188.67	884.13	30.61

...Continued

TABLE IV.7: *con't* INCREASED CAPACITY - TRANSPORT COSTS (1982-1987), MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
1984-1985					
C.W.B.					
Wheat	-	146.71	80.45	227.16	11.17
Barley	-	2.47	36.61	39.07	4.63
Oats	3.31	0.61	0.87	4.79	16.96
Total	3.31	149.79	117.92	271.02	8.51
Gov't					
Wheat	86.40	205.16	49.55	341.11	16.77
Barley	71.82	54.54	19.08	145.44	17.24
Canola	19.72	23.31	12.16	55.19	19.34
Oats	4.11	0.71	0.76	5.58	19.76
Total	182.05	283.71	81.54	547.31	17.18
System					
Wheat	124.06	439.07	151.65	714.78	35.15
Barley	103.10	78.35	64.02	245.47	29.10
Canola	28.30	33.49	17.47	79.26	27.77
Oats	8.80	1.62	1.96	12.37	43.82
Grand Total	264.25	552.54	235.09	1051.88	33.02
1985-1986					
C.W.B.					
Wheat	-	122.57	94.15	216.72	12.90
Barley	-	2.21	5.89	8.09	0.94
Oats	2.68	0.28	1.19	4.16	14.71
Total	2.68	125.07	101.23	228.98	7.97
Gov't					
Wheat	73.12	213.86	63.78	350.76	20.89
Barley	88.38	74.29	45.84	208.52	24.18
Canola	24.69	33.16	18.15	76.00	24.39
Oats	4.11	1.33	1.27	6.71	23.71
Total	190.29	322.64	129.05	641.98	22.34
System					
Wheat	93.02	392.47	175.28	660.76	39.35
Barley	112.43	94.52	58.32	265.28	30.76
Canola	31.41	42.19	23.09	96.68	31.03
Oats	7.66	1.94	2.81	12.41	43.87
Grand Total	244.52	531.12	259.50	1035.14	36.01

...Continued

TABLE IV.7: ***con't*** **INCREASED CAPACITY - TRANSPORT COSTS**

(1982-1987) MILLIONS OF DOLLARS

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
1986-1987					
C.W.B.					
Wheat	-	205.74	84.62	290.36	12.46
Barley	-	1.15	3.08	4.23	0.59
Oats	3.87	1.16	1.08	6.11	17.64
Total	3.87	208.05	88.79	300.71	9.13
Gov't					
Wheat	134.20	346.93	71.33	552.46	23.71
Barley	108.32	51.13	28.00	187.45	26.31
Canola	23.08	23.77	14.30	61.15	27.34
Oats	6.57	1.72	1.26	9.54	27.52
Total	272.17	423.55	114.89	810.60	24.60
System					
Wheat	166.28	633.98	173.36	973.62	41.78
Barley	134.23	63.36	34.70	232.28	32.60
Canola	28.60	29.46	17.72	75.77	33.88
Oats	11.66	3.28	2.65	17.58	50.72
Grand Total	340.76	730.07	228.42	1299.26	39.43
1987-1988					
C.W.B.					
Wheat	-	51.52	80.23	131.75	7.86
Barley	-	0.93	2.88	3.81	0.77
Oats	4.24	1.27	1.19	6.70	19.34
Total	4.24	53.72	84.31	142.27	5.64
Gov't					
Wheat	83.53	263.12	59.37	406.01	24.22
Barley	63.69	40.52	23.28	127.50	25.81
Canola	28.28	36.80	20.18	86.27	26.63
Oats	6.34	1.66	1.21	9.22	26.59
Total	182.85	342.10	104.05	628.99	24.94
System					
Wheat	105.48	375.83	155.18	636.49	37.97
Barley	80.43	51.61	29.40	160.99	32.60
Canola	36.98	46.47	25.48	108.93	33.62
Oats	11.87	3.36	2.72	17.96	51.81
Grand Total	234.76	476.82	212.78	924.36	36.65

V. THE C.W.B. PRICING PROPOSAL (PAY THE RAILWAY)

A. Initial Results Before Adjustments (1982 - 1987)

The purpose of this scenario is to analyze the effects of the Canadian Wheat Board Proposal, announced in Grain Matters in November 1985.[21] It was proposed that all grain sold to the C.W.B. will be based on the transportation charge to Vancouver or the St. Lawrence, whichever is lowest. Currently, Seaway charges for grain shipments through the St. Lawrence seaway system via Thunder Bay are deducted from each specific pool account and shared by all grain producers in western Canada through sales pooling. Under the new proposal, producers shipping grain through the St. Lawrence seaway would not bear any additional cost of these movements but would absorb a larger proportion of total grain transportation costs. Currently, pool accounts are operated on the basis in store Thunder Bay or Vancouver and appropriate producer freight rates are deducted from initial prices, as discussed in section I.A.3. Under the new C.W.B. proposal West Coast ports would be the more logical location for the majority of western Canadian grain exports. The new proposed policy would than result in the West Coast freight rate being deducted from initial payments.

1. Production Results (1982-1987)

Table V.1 exhibits initial crop production simulation results for the 1982 through 1987 crop years using St. Lawrence/Vancouver pricing. Under the new C.W.B. proposal, total crop production as a percentage of total estimated production (Table IV.1) would decline between 0.49 (149 thousand tonnes) during the 1985-1986 crop year to 2.44 (893 thousand tonnes) during the 1982-1983 crop year. However, hidden in these figures is the fact that this decline in crop production only occurs in the provinces of Saskatchewan and Manitoba. Alberta crop production would remain constant given that transportation costs are equivalent between the two pricing alternatives, Thunder Bay/Vancouver and St. Lawrence/Vancouver. Overall total crop production in western Canada under the new C.W.B. proposal would range between 27 and 36 million tonnes.

---

[21] Canadian Wheat Board, Grain Matters, Winnipeg, Nov./Dec., 1985.

TABLE V.1: SIMULATED INITIAL CROP PRODUCTION (1982-1987)

('000 TONNES)

CROP YEAR

CROP	82/83	83/84	84/85	85/86	86/87	87/88
ALBERTA						
Barley	5932.4	4767.3	5285.8	5231.9	5479.3	3726.1
Wheat	5966.5	4344.4	5086.4	3444.3	5573.5	3597.5
Canola	981.9	1338.0	1162.4	1163.3	957.8	1251.2
SASKATCHEWAN						
Barley	2919.9	2581.4	3014.5	3256.6	2382.7	2054.9
Wheat	13757.3	10413	11542	9551.7	13980.6	9922.3
Canola	851.6	1442.9	1218.9	1387.3	880.42	1414.5
MANITOBA						
Barley	1987.4	1948.4	2038.0	2084.9	1435.7	1323.6
Wheat	3675.5	3209	3587.9	3727.1	3670.7	3150.6
Canola	415.8	540.1	472.5	565.5	392.7	573.8
PRAIRIES						
Total	36488	30584	33408	30412.6	34758.6	27014.5

2. Producer Surplus (1982 - 1987)

This decline in crop production during the simulated period results in a reduction in producer welfare in the provinces of Saskatchewan and Manitoba (Table V.2). It was estimated during the simulated period that producer surplus would decline between 0.89 and 33 percent in Manitoba and Saskatchewan, or by 21 million to 1.2 billion dollars. A comparison of Table IV.3 to Table V.2 identifies the major decline in producer welfare for all crops to be in the province of Saskatchewan, amounted to approximately 7.2 to 409 million dollars over the simulated period.

Manitoba producers would experience a decline in producer welfare if the C.W.B. implemented their new pricing policy, by approximately 10 to 125 million dollars, during the crop periods 1982 to 1987. It is estimated that canola producers in the province of Manitoba would benefit by 291 to 703 thousand dollars under the proposed change in pricing mechanism by the Canadian Wheat Board. Under the W.G.T.A., transportation costs to producers of canola only reflect the West Coast rate, thus leaving farm gate returns unaffected by the change in the proposed pricing mechanism. In Manitoba, the cross price effects are positive and inelastic, resulting in a shift to the right of the canola supply function thereby increasing total producer welfare.

TABLE V.2: ESTIMATED PRODUCER WELFARE (1982-1987)

('000 DOLLARS)

CROP YEAR

ST. LAWRENCE/VANCOUVER PRICING

CROP	82/83	83/84	84/85	85/86	86/87	87/88
ALBERTA						
Barley	256649	171298	206631	199493	172811	63864
Wheat	219208	486184	435321	360467	358777	228827
Canola	103222	221596	172149	187721	101474	190402
SASKATCHEWAN						
Barley	186203	137337	178844	191621	90096	57736
Wheat	505444	754213	685218	604324	685187	384323
Canola	169565	379043	299662	368302	129080	276479
MANITOBA						
Barley	71880	51699	66202	69553	35461	21102
Wheat	135039	211327	241615	295442	221561	173292
Canola	37630	73124	60712	106240	41785	95027
PRAIRIES						
Total	1684841	2485821	2346355	2383163	1836233	1491052

3. Changes in Consumer Surplus (1982 - 1987)

With changes in regional prices to producers, the associated changes to consumers, i.e. livestock producers and foreign consumers, are measured. Table V.3 illustrates these changes in consumer surplus on a provincial basis. Overall, consumers would benefit by approximately 30 to 46 million dollars given St. Lawrence/Vancouver pricing under the current freight rate policy. No change would occur to Alberta consumers given the same freight rate deduction between St. Lawrence and Thunder Bay/Vancouver pricing. The largest impact was found to occur to Manitoba barley and wheat consumers. In this province barley consumers would have experienced an increase in consumer surplus of approximately 5.7 to 10.8 million dollars, and consumer welfare increases of 11.9 to 18.9 million dollars in wheat. Over the simulated period, consumer surplus to Saskatchewan wheat consumers would have increased by 8.5 to 14.6 million dollars if the price basing point was changed from Thunder Bay to the St. Lawrence under the current freight rate policy. Consumer welfare from barley purchases in Saskatchewan would also increase, by approximately 1.2 to 2.6 million dollars.

TABLE V.3: CHANGES IN CONSUMER SURPLUS (1982-1987)

('000 DOLLARS)

CROP YEAR

ST. LAWRENCE/VANCOUVER TO THUNDER BAY/VANCOUVER PRICING

CROP	82/83	83/84	84/85	85/86	86/87	87/88
SASKATCHEWAN						
Barley	1190.65	1671.38	2608.04	2322.11	1546.03	1341.99
Wheat	8563.85	11707.66	14055.27	9490.98	14569.07	11264.73
MANITOBA						
Barley	6995.60	7247.94	10760.83	8589.62	5742.75	5757.52
Wheat	12933.04	11931.77	18936.54	15347.18	14676.18	13698.29
PRAIRIES						
Total	29683.13	32558.76	46360.68	35749.89	36534.03	32062.53

Net welfare gains to the grains sector in western Canada over the simulation period is estimated to be approximately 6 to 16 million dollars if the C.W.B. act was changed to include the St. Lawrence as a price basing point. But the distribution of welfare changes vary between the prairie provinces. In the Saskatchewan barley economy, net welfare would decrease by approximately 0.84 to 2.0 million dollars from 1982 to 1987. Substantial increases in the Saskatchewan wheat economy would occur under the pricing change, of approximately 4 to 7.6 million dollars. In the Manitoba wheat and barley economy, a transfer of wealth was found to occur from producers to consumers causing a welfare gain to those sectors. In fact net welfare gains in wheat was estimated to be 5.8 to 7.6 million dollars over the simulation period. Net welfare gains to the Manitoba barley industry were approximately 1.7 to 3.5 million dollars.

4. Optimal Grain Shipping Patterns (1982-1987)

Table V.4 presents initial results of the least cost minimization shipment patterns under St. Lawrence/Vancouver pricing, with actual production and marketing conditions representing West Coast capacity during the simulated period. It was found that under current market conditions, approximately 32 to 53 percent of grain shipments would flow through West Coast ports, while Thunder Bay shipments consisted of 46 to 68 percent of total shipments. Implementation of an estimated 20 million tonne capacity at West Coast ports shows approximately 13 to 51 percent more grain being efficiently shipped through the Pacific Coast than under current production and marketing conditions representing the West Coast restriction over the simulated period.

TABLE V.4: GRAIN FLOWS UNDER THE C.W.B. PROPOSAL

Millions of Tonnes , (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
11.3 MILLION TONNE WEST COAST CONSTRAINT (1982-1983).						
WEST COAST						
ALBERTA	0.73	5.03	0.98	-	6.74	55.34
SASKATCHEWAN	-	2.68	0.85	-	3.53	22.13
MANITOBA	-	0.62	0.42	-	1.04	19.08
TOTAL	0.73	8.33	2.25	-	11.30	32.30
EAST COAST						
ALBERTA	5.24	-	-	0.20	5.44	44.66
SASKATCHEWAN	13.76	-	-	0.07	13.83	77.87
MANITOBA	3.68	0.66	-	0.07	4.41	80.92
TOTAL	22.68	0.66	-	0.34	23.68	67.70
11.7 MILLION TONNE WEST COAST CONSTRAINT (1983-1984).						
WEST COAST						
ALBERTA	1.25	3.87	1.34	-	6.46	65.99
SASKATCHEWAN	-	2.07	1.44	-	3.51	25.13
MANITOBA	-	1.19	0.54	-	1.73	34.67
TOTAL	1.25	7.13	3.32	-	11.70	40.70
EAST COAST						
ALBERTA	3.10	-	-	0.23	3.33	34.01
SASKATCHEWAN	10.37	-	-	0.09	10.46	74.87
MANITOBA	3.21	-	-	0.05	3.26	65.33
TOTAL	16.68	-	-	0.37	17.05	59.30
10 MILLION TONNE WEST COAST CONSTRAINT (1984-1985)						
WEST COAST						
ALBERTA	0.60	4.24	1.16	-	6.00	56.23
SASKATCHEWAN	-	2.30	1.22	-	3.52	22.68
MANITOBA	-	-	0.47	-	0.47	8.61
TOTAL	0.60	6.54	2.85	-	10.00	31.59
EAST COAST						
ALBERTA	4.48	-	-	0.19	4.67	43.77
SASKATCHEWAN	11.50	0.46	-	0.04	12.00	77.32
MANITOBA	3.59	1.34	-	0.06	4.99	91.39
TOTAL	19.57	1.80	-	0.29	21.66	68.41

...Continued

TABLE V.4: con't GRAIN FLOWS UNDER THE C.W.B. PROPOSAL

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
12 MILLION TONNE WEST COAST CONSTRAINT (1985-1986).						
WEST COAST						
ALBERTA	0.45	4.17	1.16	-	5.78	64.73
SASKATCHEWAN	-	3.00	1.39	-	4.39	31.49
MANITOBA	-	1.26	0.57	-	1.83	31.88
TOTAL	0.45	8.43	3.12	-	12.00	41.94
EAST COAST						
ALBERTA	3.00	-	-	0.15	3.15	35.27
SASKATCHEWAN	9.49	-	-	0.06	9.55	68.51
MANITOBA	3.73	0.11	-	0.07	3.91	68.12
TOTAL	16.22	0.11	-	0.28	16.61	58.06
15.7 MILLION TONNE WEST COAST CONSTRAINT (1986-1987).						
WEST COAST						
ALBERTA	5.57	4.50	0.96	-	11.03	98.13
SASKATCHEWAN	0.84	1.83	0.89	-	3.56	21.28
MANITOBA	-	0.72	0.39	-	1.11	22.89
TOTAL	6.41	7.05	2.24	-	15.70	47.84
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	1.87
SASKATCHEWAN	13.10	-	-	0.07	13.17	78.72
MANITOBA	3.67	-	-	0.07	3.74	77.11
TOTAL	4.98	-	-	0.35	17.12	52.16
13.4 MILLION TONNE WEST COAST CONSTRAINT (1987-1988).						
WEST COAST						
ALBERTA	3.60	2.75	1.25	-	7.60	97.31
SASKATCHEWAN	1.71	1.51	1.41	-	4.63	95.07
MANITOBA	-	0.60	0.57	-	1.17	26.65
TOTAL	5.31	4.86	3.36	-	13.40	53.45
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	2.69
SASKATCHEWAN	8.17	-	-	0.07	8.24	4.93
MANITOBA	3.15	-	-	0.07	3.22	73.35
TOTAL	11.32	-	-	0.35	11.67	46.55

TABLE V.5: GRAIN FLOWS WITH INCREASED CAPACITY

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
1982-1983						
WEST COAST						
ALBERTA	5.97	5.03	0.98	-	11.98	98.36
SASKATCHEWAN	2.80	2.68	0.85	-	6.33	36.46
MANITOBA	-	1.28	0.42	-	1.70	31.19
TOTAL	8.77	8.99	2.25	-	20.00	57.18
EAST COAST						
ALBERTA	-	-	-	0.20	0.20	1.64
SASKATCHEWAN	10.96	-	-	0.07	11.03	63.54
MANITOBA	3.68	-	-	0.07	3.75	68.81
TOTAL	14.64	-	-	0.34	14.98	42.82
1983-1984						
WEST COAST						
ALBERTA	4.34	3.87	1.34	-	9.55	97.65
SASKATCHEWAN	5.21	2.07	1.44	-	8.72	62.37
MANITOBA	-	1.19	0.54	-	1.73	34.67
TOTAL	9.55	7.13	3.32	-	20.00	69.57
EAST COAST						
ALBERTA	-	-	-	0.23	0.23	2.35
SASKATCHEWAN	5.17	-	-	0.09	5.26	37.63
MANITOBA	3.21	-	-	0.05	3.26	65.33
TOTAL	8.38	-	-	0.37	8.75	30.43
1984-1985						
WEST COAST						
ALBERTA	5.09	4.24	1.16	-	10.49	98.22
SASKATCHEWAN	5.06	2.76	1.22	-	9.04	58.25
MANITOBA	-	-	0.47	-	0.47	8.61
TOTAL	10.15	7.00	2.85	-	20.00	36.83
EAST COAST						
ALBERTA	-	-	-	0.19	0.19	1.78
SASKATCHEWAN	6.44	-	-	0.04	6.48	41.75
MANITOBA	3.59	1.34	-	0.06	4.99	91.39
TOTAL	10.03	1.34	-	0.29	11.66	63.17

...Continued

TABLE V.5: con't GRAIN FLOWS WITH INCREASED CAPACITY

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
1985-1986						
WEST COAST						
ALBERTA	3.44	4.17	1.16	-	8.77	99.44
SASKATCHEWAN	4.85	3.00	1.39	0.04	9.28	66.57
MANITOBA	-	1.37	0.57	-	1.94	33.80
TOTAL	8.29	8.54	3.12	0.04	20.00	69.91
EAST COAST						
ALBERTA	-	-	-	0.15	0.15	0.56
SASKATCHEWAN	4.64	-	-	0.02	4.66	33.43
MANITOBA	3.73	-	-	0.07	3.80	66.20
TOTAL	8.37	-	-	0.24	8.61	30.09
1986-1987						
WEST COAST						
ALBERTA	5.57	4.50	0.96	-	11.03	98.13
SASKATCHEWAN	5.14	1.83	0.89	-	7.86	46.98
MANITOBA	-	0.72	0.39	-	1.11	22.89
TOTAL	10.71	7.05	2.24	-	20.00	60.94
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	1.87
SASKATCHEWAN	8.80	-	-	0.07	8.87	53.02
MANITOBA	3.67	-	-	0.07	3.74	77.11
TOTAL	12.47	-	-	0.35	12.82	39.06
1987-1988						
WEST COAST						
ALBERTA	3.60	2.75	1.25	-	7.60	97.31
SASKATCHEWAN	8.31	1.51	1.41	-	11.23	87.26
MANITOBA	-	0.60	0.57	-	1.17	26.65
TOTAL	11.91	4.86	3.23	-	20.00	79.78
EAST COAST						
ALBERTA	-	-	-	0.21	0.21	2.69
SASKATCHEWAN	1.57	-	-	0.07	1.64	12.74
MANITOBA	3.15	-	-	0.07	3.22	73.35
TOTAL	4.72	-	-	0.35	5.07	20.22

5. Shipping Costs (1982-1987)

Provincial grain shipping costs for the simulated period under the two different capacity constraints (current production and marketing conditions and a 20 million tonne constraint) are illustrated in Tables V.6 and V.7. It was estimated that total logistic costs under St.

Lawrence/Vancouver pricing would range from a low of 622.94 million dollars (17.85/tonne) to a high of 1.4 billion dollars (42.09/tonne) given that actual production and marketing conditions represent West Coast capacity. A comparison of total system shipping costs under Thunder Bay/Vancouver pricing to St. Lawrence/Vancouver pricing with current conditions representing West Coast capacity results in a 0.63 (3.94 million dollars) to 0.99 (10.4 million dollars) percent decrease in these costs. But, in terms of magnitude, these costs could decrease by as much as 11.93 million dollars, or by 0.92 percent during the 1984 crop year.

Producer costs under St. Lawrence/Vancouver pricing with actual production and marketing conditions representing West Coast export capacity range from 180.78 to 274.55 million dollars over the simulated period. This represents approximately a 16 to 18 percent increase in producer shipping costs. The largest impact occurs in the province of Manitoba where producer shipping costs for wheat are estimated to increase between 11.7 and 18.54 million dollars. Also barley shipping costs to Manitoba producers would increase over the simulated period, by approximately 2.61 to 6.63 million dollars. In Saskatchewan this increase in producer shipment costs for all grains is somewhat narrower than in Manitoba. In fact, wheat shipping costs are estimated to increase between 8.7 to 14.03 million dollars, and barley freight costs by 1.0 to 2.21 million dollars over the simulated period.

Given the least cost shipment patterns discussed previously, the federal Government commitment amounts to approximately 549.81 to 798 million dollars on all grain shipments during the simulated period. The majority of these costs occurs on Saskatchewan wheat and Alberta barley shipments. Overall, this government commitment would decrease by approximately 3.83 to 5.63 million dollars during the 1982 through 1987 crop years.

Under St. Lawrence/Vancouver pricing with current production and marketing conditions representing West Coast capacity, results in the C.W.B paying approximately 266.38 ($10.63/tonne) to 448.37 ($14.92/tonne) million dollars on all grain shipments. During the simulated period the change in C.W.B. shipping costs over the baseline scenario represents a decline of approximately 7 (31.10 million dollars) to 11 (33.48 million dollars) percent. But C.W.B. costs on all grain shipments declined during the 1984-1985 crop year by 48.9 million dollars. This decrease in C.W.B. shipping costs is related not only to producers paying a larger proportion of total transportation charges but also to less grain being shipped under the new pricing proposal. In summary, introduction of the new C.W.B. proposal results in a shift in marketing costs from the C.W.B. to producers and at the same time allows the Government commitment on all grain shipments to decline.

TABLE V.6: GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY					
1982-1983					
Producer					
Wheat	28.93	74.11	25.91	128.95	5.51
Barley	24.31	14.10	9.00	47.40	5.28
Canola	4.76	4.41	2.93	12.09	5.38
Oats	0.96	0.35	0.47	1.79	5.34
Total	58.95	92.97	38.31	190.23	5.45
C.W.B.					
Wheat	104.72	253.77	57.27	415.75	17.77
Barley	-	-	13.37	13.37	1.49
Oats	2.42	0.69	0.48	3.60	10.75
Total	107.15	254.45	71.12	432.72	12.40
System					
Wheat	133.65	327.87	83.18	544.71	23.28
Barley	24.31	14.10	22.36	60.77	6.76
Canola	4.76	4.41	2.93	12.09	5.38
Oats	3.39	1.04	0.95	5.38	16.09
Grand Total	166.10	347.42	109.42	622.94	17.85

...*Continued*

TABLE V.6: *con't* GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY.					
1983-1984					
Producer					
Wheat	23.32	67.86	24.68	115.86	6.46
Barley	20.34	13.04	9.18	42.57	5.97
Canola	7.12	8.96	4.15	20.23	6.09
Oats	1.18	0.55	0.39	2.12	5.83
Total	51.96	90.42	38.40	180.78	6.30
C.W.B.					
Wheat	62.26	194.92	51.86	309.04	17.23
Barley	-	-	-	-	-
Oats	3.47	1.19	0.54	5.20	14.31
Total	65.73	196.12	52.39	314.24	10.95
Gov't					
Wheat	90.50	191.17	46.43	328.10	18.30
Barley	69.85	42.89	32.72	145.46	20.40
Canola	24.43	29.49	14.80	68.72	20.69
Oats	5.33	1.47	0.73	7.54	20.75
Total	190.10	265.03	94.68	549.81	19.16
System					
Wheat	176.08	453.96	122.96	753.00	41.99
Barley	90.19	55.93	41.90	188.02	26.38
Canola	31.55	38.45	18.95	88.95	26.78
Oats	9.97	3.22	1.66	14.85	40.88
Grand Total	307.78	551.56	185.48	1044.83	36.41

...Continued

TABLE V.6: *con't* GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY.					
1984-1985					
Producer					
Wheat	37.66	100.50	40.19	178.34	8.84
Barley	31.28	23.56	14.97	69.81	8.38
Canola	8.58	10.19	5.29	24.06	8.43
Oats	1.37	0.34	0.63	2.34	8.27
Total	78.89	134.59	61.07	274.55	8.69
C.W.B.					
Wheat	105.88	239.35	59.99	405.22	20.09
Barley	-	11.01	27.69	38.70	4.64
Oats	3.31	0.57	0.57	4.45	15.77
Total	109.19	250.93	88.25	448.37	14.19
Gov't					
Wheat	105.04	203.76	48.62	357.42	17.72
Barley	71.82	52.16	18.11	142.09	17.05
Canola	19.72	23.34	12.12	55.17	19.33
Oats	4.11	0.66	0.76	5.54	19.61
Total	200.69	279.92	79.60	560.21	17.73
System					
Wheat	248.58	543.61	148.79	940.98	46.64
Barley	103.10	86.73	60.77	250.59	30.06
Canola	28.30	33.53	17.41	79.24	27.77
Oats	8.80	1.57	1.96	12.33	43.65
Grand Total	388.77	665.44	228.92	1283.13	40.62

...Continued

TABLE V.6: *con't* GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY.					
1985-1986					
Producer					
Wheat	19.90	64.92	32.54	117.35	7.04
Barley	24.06	20.07	11.99	56.11	6.57
Canola	6.72	9.04	4.94	20.69	6.64
Oats	0.87	0.37	0.65	1.90	6.70
Total	51.55	94.39	50.12	196.05	6.87
C.W.B.					
Wheat	78.84	228.34	77.90	385.08	23.11
Barley	-	-	2.98	2.98	0.35
Oats	2.68	0.84	0.89	4.41	15.59
Total	81.53	229.19	81.77	392.48	13.75
Gov't					
Wheat	87.26	204.70	63.18	355.13	21.31
Barley	88.38	73.70	42.39	204.47	23.92
Canola	24.69	33.18	18.14	76.01	24.39
Oats	4.11	1.06	1.27	6.45	22.78
Total	204.43	312.64	124.97	642.05	22.50
System					
Wheat	186.00	497.96	173.61	857.57	51.46
Barley	112.43	93.77	57.36	263.56	30.84
Canola	31.41	42.22	23.08	96.70	31.03
Oats	7.66	2.28	2.81	12.75	45.07
Grand Total	337.50	636.22	256.86	1230.58	43.12

...Continued

TABLE V.6: ***con't*** **GRAIN SHIPPING COSTS (1982-1987)**

MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY.					
1986-1987					
Producer					
Wheat	32.08	95.34	31.90	159.32	6.87
Barley	25.09	12.07	6.22	44.20	6.27
Canola	5.52	5.69	3.41	14.62	6.54
Oats	1.21	0.46	0.57	2.24	6.46
Total	64.72	113.56	42.10	220.38	6.73
C.W.B.					
Wheat	-	284.17	68.97	353.14	15.23
Barley	-	-	-	-	-
Oats	3.87	1.09	0.82	5.79	16.70
Total	3.87	285.26	69.79	358.93	10.96
Gov't					
Wheat	134.20	338.93	70.51	543.64	23.45
Barley	108.32	50.49	26.03	184.84	26.22
Canola	23.08	23.79	14.27	61.14	27.34
Oats	6.57	1.48	1.26	9.30	26.84
Total	272.17	414.68	112.07	798.92	24.40
System					
Wheat	166.28	718.44	171.38	1056.11	45.56
Barley	134.23	62.56	32.25	229.04	32.49
Canola	28.60	29.48	17.69	75.76	33.88
Oats	11.66	3.03	2.65	17.33	49.99
Grand Total	340.76	813.50	223.97	1378.23	42.09

...Continued

An increase in West Coast capacity to 20 million tonnes under St. Lawrence/Vancouver pricing results in total shipment costs for all grains ranging from 455.22 million to 1.3 billion dollars or $12.98/tonne to $39.43/tonne (Table V.7). This increase in West Coast capacity under St. Lawrence/Vancouver pricing would result in a further decline in marketing costs to the total system

TABLE V.6: *con't* GRAIN SHIPPING COSTS (1982-1987)

MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
CURRENT CONDITIONS AS WEST COAST CAPACITY.					
1987-1988					
Producer					
Wheat	21.95	72.21	29.05	123.21	7.39
Barley	16.74	10.47	5.57	32.78	6.75
Canola	7.69	9.68	5.29	22.66	6.99
Oats	1.29	0.49	0.60	2.38	6.85
Total	47.67	92.85	40.51	181.02	7.23
C.W.B.					
Wheat	-	194.75	65.28	260.03	15.60
Barley	-	-	-	-	-
Oats	4.24	1.20	0.91	6.35	18.32
Total	4.24	195.95	66.19	266.38	10.63
Gov't					
Wheat	83.53	232.30	58.44	374.27	22.45
Barley	63.69	39.87	21.21	124.77	25.69
Canola	29.28	36.83	20.15	86.26	26.63
Oats	6.35	1.43	1.21	8.99	25.93
Total	182.85	310.42	101.02	594.29	23.73
System					
Wheat	105.48	499.26	152.77	757.51	45.44
Barley	80.43	50.34	26.78	157.55	32.44
Canola	36.98	46.50	25.44	108.92	33.62
Oats	11.87	3.12	2.72	17.71	51.10
Grand Total	234.76	599.22	207.72	1041.69	41.59

of approximately 90.15 to 243.06 million dollars. This suggests that the current production and marketing conditions at West Coast ports costs western Canadian grain producers an extra 167.72 million to 0.1 billion dollars or $2.66 to $4.87 per tonne under St. Lawrence/Vancouver pricing.

Producer costs remain constant between the two constraint levels under St. Lawrence/Vancouver pricing. The impacts to producers, therefore, would be as previously discussed under current production and marketing conditions representing West Coast capacity.

Relaxing the West Coast shipment constraint to 20 million tonnes results in C.W.B. shipping costs for all grains declining by a further 124.11 to 147.66 million dollars. The majority of this decline is estimated to occur for wheat in Saskatchewan, and barley in Manitoba. Producer costs of transportation would, therefore, reflect the direction of grain shipments.

TABLE V.7: SHIPMENT COSTS - MAXIMUM CAPACITY

(1982-1987) MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
1982-1983					
C.W.B.					
Wheat	-	200.27	57.27	257.54	11.01
Barley	-	-	-	-	-
Oats	2.42	0.69	0.48	3.60	10.75
Total	2.42	200.96	57.75	261.13	7.48
System					
Wheat	28.93	274.38	83.18	386.49	16.52
Barley	24.31	14.10	9.00	47.40	5.28
Canola	4.76	4.41	2.93	12.09	5.38
Oats	3.39	1.04	0.95	5.38	16.09
Grand Total	61.38	293.93	96.06	451.36	12.93
1983-1984					
C.W.B.					
Wheat	-	93.34	51.86	145.20	8.10
Barley	-	-	-	-	-
Oats	3.47	1.19	0.54	5.20	14.31
Total	3.47	94.54	52.39	150.40	5.24
Gov't					
Wheat	78.82	197.46	46.43	322.71	18.00
Barley	69.85	42.89	32.72	145.46	20.40
Canola	24.43	29.49	14.80	68.72	20.69
Oats	5.33	1.47	0.73	7.54	20.75
Total	178.42	271.32	94.68	544.42	18.97
System					
Wheat	102.14	358.66	122.96	583.77	32.56
Barley	90.19	55.93	41.90	188.02	26.38
Canola	31.55	38.45	18.95	88.95	26.78
Oats	9.97	3.22	1.66	14.85	40.88
Grand Total	233.84	456.27	185.48	875.59	30.52

...Continued

TABLE V.7: ***con't*** **SHIPMENT COSTS - MAXIMUM CAPACITY**

(1982-1987) MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
1984-1985					
C.W.B.					
Wheat	-	130.10	59.99	190.09	9.42
Barley	-	-	27.69	27.69	3.32
Oats	3.31	0.57	0.57	4.45	15.77
Total	3.31	130.67	88.25	222.23	7.03
Gov't					
Wheat	86.40	203.67	48.62	338.69	16.79
Barley	71.82	53.96	18.11	143.89	17.26
Canola	19.72	23.34	12.12	55.17	19.33
Oats	4.11	0.66	0.76	5.54	19.61
Total	182.05	281.64	79.60	543.29	17.20
System					
Wheat	124.06	434.27	148.79	707.12	35.05
Barley	103.10	77.53	60.77	241.39	28.96
Canola	28.30	33.53	17.41	79.24	27.77
Oats	8.80	1.57	1.96	12.33	43.65
Grand Total	264.25	546.90	228.92	1040.07	32.92
1985-1986					
C.W.B.					
Wheat	-	108.98	77.90	186.88	11.21
Barley	-	-	-	-	-
Oats	2.68	0.84	0.89	4.41	15.59
Total	2.68	109.82	78.78	191.29	6.70
Gov't					
Wheat	73.12	212.20	63.18	348.49	20.91
Barley	88.38	73.70	44.05	206.13	24.12
Canola	24.69	33.18	18.14	76.01	24.39
Oats	4.11	1.06	1.27	6.45	22.78
Total	190.29	320.15	126.64	637.07	22.32
System					
Wheat	93.02	386.10	173.61	652.72	39.16
Barley	112.43	93.77	56.04	262.24	30.68
Canola	31.41	42.22	23.08	96.70	31.03
Oats	7.66	2.28	2.81	12.75	45.07
Grand Total	244.52	524.36	255.53	1024.42	35.90

...Continued

TABLE V.7: ***con't*** **SHIPMENT COSTS - MAXIMUM CAPACITY**

(1982-1987) MILLIONS OF DOLLARS

ST. LAWRENCE/VANCOUVER PRICING

Crop Year and Cost Type	Alberta	Sask.	Manitoba	Total	Per Tonne
1986-1987					
C.W.B.					
Wheat	-	187.69	68.97	256.66	11.07
Barley	-	-	-	-	-
Oats	3.87	1.09	0.82	5.79	16.70
Total	3.87	188.78	69.79	262.44	8.01
Gov't					
Wheat	134.20	345.26	70.51	549.98	23.73
Barley	108.32	50.49	26.03	184.84	26.22
Canola	23.08	23.79	14.27	61.14	27.34
Oats	6.57	1.48	1.26	9.30	26.84
Total	272.17	421.01	112.07	805.26	24.59
System					
Wheat	166.28	628.29	171.38	965.95	41.67
Barley	134.23	62.56	32.25	229.04	32.49
Canola	28.60	29.48	17.69	75.76	33.88
Oats	11.66	3.03	2.65	17.33	49.99
Grand Total	340.76	723.35	223.97	1288.08	39.33
1987-1988					
C.W.B.					
Wheat	-	36.33	65.28	101.61	6.11
Barley	-	-	-	-	-
Oats	4.24	1.20	0.91	6.35	18.32
Total	4.24	37.53	66.19	107.96	4.32
Gov't					
Wheat	83.53	261.89	58.44	403.86	24.29
Barley	63.69	39.87	21.21	124.77	25.69
Canola	29.28	36.83	20.15	86.26	26.63
Oats	6.35	1.43	1.21	8.99	25.93
Total	182.85	340.02	101.02	623.89	24.95
System					
Wheat	105.48	370.08	152.77	628.33	37.79
Barley	80.43	50.34	26.78	157.55	32.44
Canola	36.98	46.50	25.44	108.92	33.62
Oats	11.87	3.12	2.72	17.71	51.10
Grand Total	234.76	470.05	207.72	912.52	36.50

6. Cost Savings (1982-1987)

Under the current Western Grain Transportation Act, charging all grain producers the Vancouver freight rate does not, in fact, reduce Thunder Bay marketing costs unless the grain actually is moved through the West Coast ports. Also, increasing freight rates to all producers shipping to Thunder Bay by the Vancouver freight rate reduces the initial price of grain but does not reduce the additional costs incurred by the specific pool accounts. Therefore, the difference between the deducted freight rate and the actual rate would enter into pool accounts as a cost savings (revenue). Table V.8 and V.9 illustrate the level of these cost savings on a provincial basis during the simulated period.

Cost comparisons were used to determine the level of cost savings.[22] These comparisons consisted of the following:

A-1. Comparison of St. Lawrence/Vancouver pricing to Thunder Bay/Vancouver pricing with actual production and marketing conditions representing West Coast capacity.

A-2. Comparison of St. Lawrence/Vancouver pricing with a 20 million tonne constraint at West Coast ports to Thunder Bay/Vancouver pricing with actual production and marketing conditions representing West Coast capacity.

Cost savings associated with the previous grain shipment comparisons suggest increases in initial prices. Under cost scenario A-1 this increase would be $1.02/tonne to $1.81/tonne for wheat, and $0.60/tonne to $1.45/tonne for barley over the simulated period. Initial prices would increase by $5.62/tonne to $12.47/tonne for wheat and $0.60/tonne to $2.77/tonne for barley under the A-2 cost comparison.

---

[22] It was determined by Stickland K. (1985) that the new C.W.B. pricing proposal would result in a $2 - $3/tonne drop in barley prices for Manitoba. Alberta ans Saskatchewan locations west of "Scott" midpoint would enjoy a rise of $1.90/tonne in barley prices. Points in Eastern and Central Saskatchewan would see up to $1.77/tonne drop in barley prices. These estimates are based on a 50:50 split in east/west shipping patterns. Kraft D. (1986), on the other hand, suggests that prices will drop across the prairies by $1.90/tonne. The net loss of income to Manitoba is $10.4 million while Saskatchewan farmers would receive about as much as they paid in added freight rates. Lerohl M.L. (1987) found an increase in prices amounting to $1 - $2/tonne as a result of the realignment of rail rates. This is based on a 60:40 split between the Lakehead and West Coast grain exports. Previous research under the C.W.B. pricing proposal has not dealt with any production response changes over time.

TABLE V.8: COST SAVINGS SCENARIO A-1 (1982-1987)

Millions of Dollars

PROVINCE	WHEAT	BARLEY	OATS	TOTAL
1982-1983				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	10.12	1.11	0.51	11.29
Per Tonne	0.74	0.42	0.76	0.65
Manitoba	13.67	5.92	0.23	19.81
Per Tonne	3.72	4.64	3.52	3.52
Total	23.79	7.03	0.28	31.10
Per Tonne	1.02	0.78	0.85	0.89
1983-1984				
Alberta	1.37	-	-	1.37
Per Tonne	0.31	-	-	0.14
Saskatchewan	13.25	1.34	0.07	14.66
Per Tonne	1.28	0.65	0.76	1.05
Manitoba	12.77	4.61	0.19	17.56
Per Tonne	3.98	3.86	3.72	3.52
Total	27.39	5.95	0.26	33.59
Per Tonne	1.53	0.83	0.70	1.17
1984-1985				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	16.03	3.16	0.04	19.22
Per Tonne	1.39	1.14	0.99	1.24
Manitoba	20.46	8.92	0.30	29.67
Per Tonne	5.70	6.67	5.28	5.44
Total	36.49	12.08	0.34	48.90
Per Tonne	1.81	1.45	1.18	1.55

...Continued

TABLE V.8: *con't* COST SAVINGS SCENARIO A-1 (1982-1987)

Millions of Dollars

1985-1986				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	11.70	2.21	0.06	13.96
Per Tonne	1.23	0.74	0.99	1.00
Manitoba	16.25	8.01	0.31	24.57
Per Tonne	4.36	5.83	4.12	4.28
Total	27.95	10.22	0.36	38.53
Per Tonne	1.68	1.20	1.29	1.35
1986-1987				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	18.12	1.15	0.07	19.36
Per Tonne	1.30	0.63	0.94	1.16
Manitoba	15.65	3.08	0.26	18.99
Per Tonne	4.26	4.30	4.00	3.92
Total	33.77	4.23	0.33	38.33
Per Tonne	1.46	0.60	0.94	1.17
1987-1988				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	14.36	0.93	0.07	15.36
Per Tonne	1.45	0.61	1.00	1.19
Manitoba	14.95	2.88	0.29	18.12
Per Tonne	4.75	4.77	4.35	4.12
Total	29.31	3.81	0.35	33.48
Per Tonne	1.76	0.78	1.02	1.33

TABLE V.9: COST SAVINGS SCENARIO A-2 (1982-1987)

Millions of Dollars

PROVINCE	WHEAT	BARLEY	OATS	TOTAL
1982-1983				
Alberta	104.72	-	-	104.72
Per Tonne	17.55	-	-	8.60
Saskatchewan	63.62	1.11	0.05	64.78
Per Tonne	4.62	0.42	0.76	3.73
Manitoba	13.67	19.28	0.23	33.18
Per Tonne	3.72	15.11	3.52	6.11
Total	182.00	20.40	0.28	202.69
Per Tonne	7.78	2.27	0.85	5.80
1983-1984				
Alberta	63.63	-	-	63.63
Per Tonne	14.65	-	-	6.51
Saskatchewan	114.84	1.34	0.07	116.24
Per Tonne	11.06	0.65	0.76	8.32
Manitoba	12.77	4.61	0.19	17.57
Per Tonne	3.98	3.86	3.72	3.52
Total	191.23	5.95	0.26	197.43
Per Tonne	10.66	0.83	0.70	6.87
1984-1985				
Alberta	105.88	-	-	105.88
Per Tonne	20.82	-	-	9.92
Saskatchewan	125.28	14.17	0.04	139.49
Per Tonne	10.89	5.13	0.99	8.99
Manitoba	20.46	8.92	0.30	29.67
Per Tonne	5.70	6.67	5.28	5.44
Total	251.62	23.09	0.34	275.04
Per Tonne	12.47	2.77	1.18	8.69

...Continued

TABLE V.9: *con't* COST SAVINGS SCENARIO A-2 (1982-1987)

Millions of Dollars

1985-1986				
Alberta	78.84	-	-	78.84
Per Tonne	22.89	-	-	8.83
Saskatchewan	64.81	2.21	0.06	67.07
Per Tonne	6.83	0.74	0.99	4.81
Manitoba	15.36	11.00	0.31	26.66
Per Tonne	4.12	8.01	4.12	4.64
Total	159.00	13.21	0.37	172.58
Per Tonne	9.54	1.55	1.29	6.03
1986-1987				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	114.61	1.15	0.07	115.82
Per Tonne	8.22	0.63	0.94	6.93
Manitoba	15.65	3.08	0.26	18.99
Per Tonne	4.26	4.30	4.00	3.92
Total	130.26	4.23	0.33	134.81
Per Tonne	5.62	0.60	0.94	4.11
1987-1988				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	85.90	0.93	0.07	86.90
Per Tonne	8.70	0.61	1.00	6.75
Manitoba	14.95	2.88	0.29	18.12
Per Tonne	4.75	4.77	4.35	4.12
Total	100.85	3.81	0.35	105.02
Per Tonne	6.07	0.78	1.02	4.19

B. Policy Adjustments

1. Adjusted Production (1982-1987)

Since the C.W.B. policy is to pool prices at both St. Lawrence and Vancouver, this results in initial prices being adjusted for both wheat and barley by the amount of these cost savings. It is assumed that the C.W.B. could calculate these cost savings before initial prices are announced prior to seeding decisions. This increase in initial payments would not only vary according to transport rates and volumes but by shipment patterns. Therefore, an augmented run was made to determine the effects of this increase on wheat, barley, and canola production, returns, and shipping patterns.

These cost savings are inserted back into the sub regional supply functions, through changes in wheat and barley prices under each cost scenario, to determine new levels of crop production. It was estimated under cost scenario A-1 that total grain production over the simulated period would vary between 26 and 35 million tonnes (Figure V.1 through V.3). This represents approximately a 1.3 to 2.06 million tonne decline in grain production over the baseline scenario.

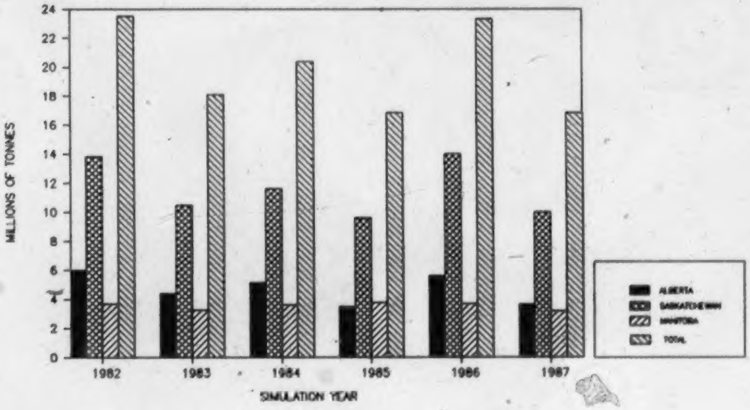


Figure V.1: Adjusted Wheat Production Under Cost Scenario A-1

In Alberta it was found that crop production would increase marginally given the savings found in scenario A-1. The production simulation sub model estimates the range in this increase in barley, wheat, and canola production to be: 6.93 to 49.9 thousand tonnes for barley, 35.23 to 51.52 thousand tonnes for wheat, and 0.54 to 2.77 thousand tonnes for canola. Saskatchewan barley producers are estimated to experience a 2.46 to 734.7 thousand tonne decline in production over the simulated period. Also, canola production within the province of Saskatchewan would decline marginally, by 1.16 to 36.47 thousand tonnes. Saskatchewan under cost scenario A-1 is estimated to produce more wheat, given a price policy change, approximately 8.29 to 27.39 thousand tonnes. The largest impact on production is found in the province of Manitoba, where barley production would decline by approximately 37.16 to 51.95 thousand tonnes, and wheat production could decrease by as much as 18.64 to 47.21 thousand tonnes. Canola production in Manitoba, on the other hand, is estimated to increase by 0.42 to 1.09 thousand tonnes during the simulated period with calculated savings in scenario A-1. During the 1984-1985 crop year it is estimated that Manitoba canola production would decrease by 1.29 thousand tonnes.

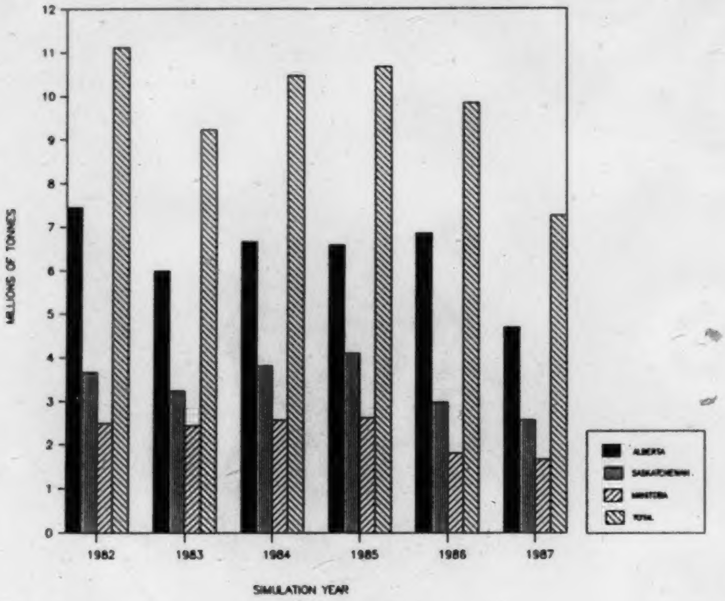


Figure V.2: Adjusted Barley Production - Cost Scenario A-1

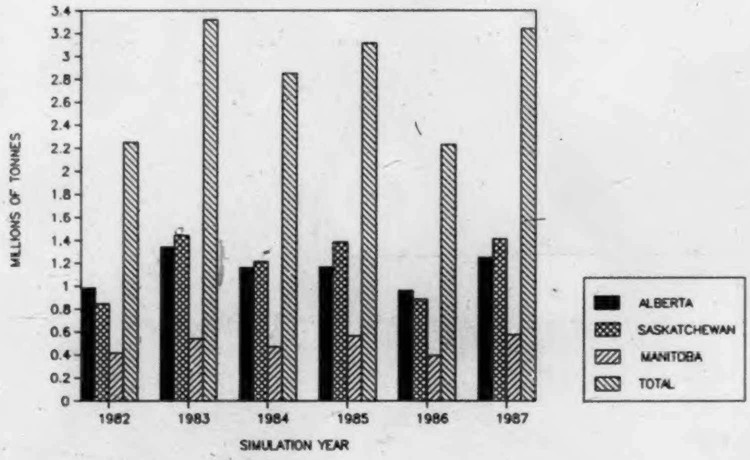


Figure V.3: Adjusted Canola Production - Cost Scenario A-1

Given the cost savings found under cost scenario A-2, total grain production over the simulated period was estimated to vary between 26 and 35 million tonnes (Figures V.4 to V.6). This represents approximately a 3.9 (1.3 million tonnes) to 6 (1.7 million tonnes) percent decrease over baseline grain production levels. On a aggregate basis, production results are similar under both cost scenarios. But the provincial production impacts given a grain price policy change varies between both cost scenarios, A-1 and A-2.

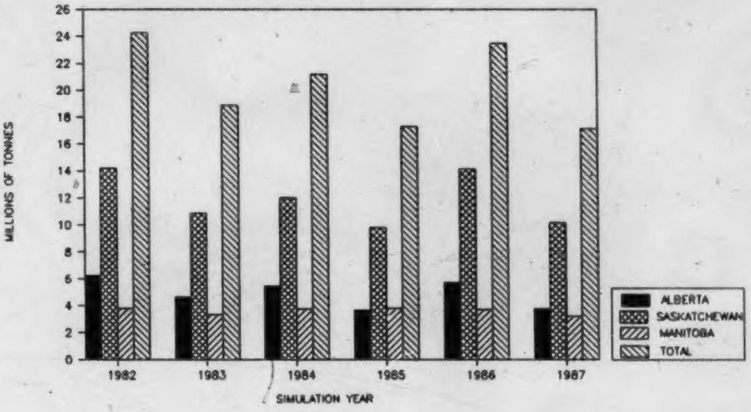


Figure V.4: Adjusted Wheat Production Under Cost Scenario A-2

In fact, it is estimated that barley production, with cost savings in scenario A-2, would have increased in Alberta between 0.04 (1.93 thousand tonnes) and 1.32 (78.42 thousand tonnes) percent, if the C.W.B. had implemented their pricing proposal during the 1982 through 1987 crop years. During the 1983 and 1987 crop years barley produced in Alberta declined by 28.99 and 28.75 thousand tonnes respectively. Major impacts to Alberta wheat production would occur during the simulated period under St. Lawrence/Vancouver pricing with cost savings estimated in scenario A-2, approximately 125.48 to 354.02 thousand tonnes. During the same period, total Alberta canola production would also increase, by approximately 0.60 (5.74 thousand tonnes) to 2.17 (29.10 thousand tonnes) percent.

In Saskatchewan, over the simulated period, wheat production is expected to increase between 73.62 and 426.88 thousand tonnes. Barley and canola production in Saskatchewan, on the other hand, would decline. This decrease is estimated to range between 92.19 and 775.74 thousand tonnes for barley, and 16.5 and 54.03 thousand tonnes for canola. Wheat production in Manitoba,

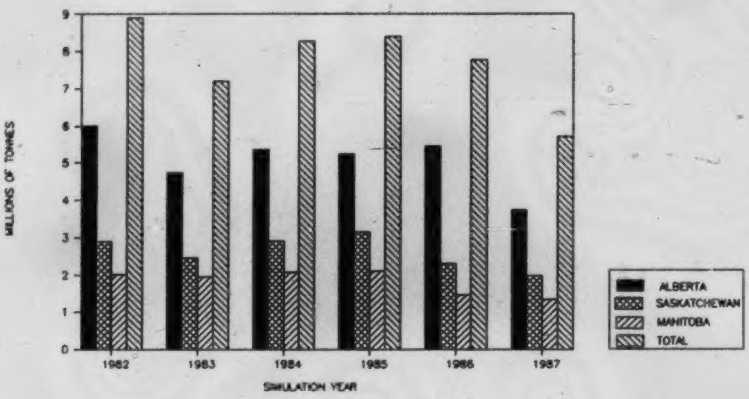


Figure V.5: Adjusted Barley Production - Cost Scenario A-2

when compared to the baseline scenario, is estimated to increase by 19.38 and 104.74 thousand tonnes during the simulated period. Barley production over the the same time frame is expected to decline by 16.95 to 48.42 thousand tonnes. Canola production, because of a price policy change and estimated cost savings under cost scenario A-2, would increase by 3.96 to 15.81 thousand tonnes from 1982 to 1987. During the 1986 crop year, canola production decreased by 1.5 thousand tonnes with A-2 savings.

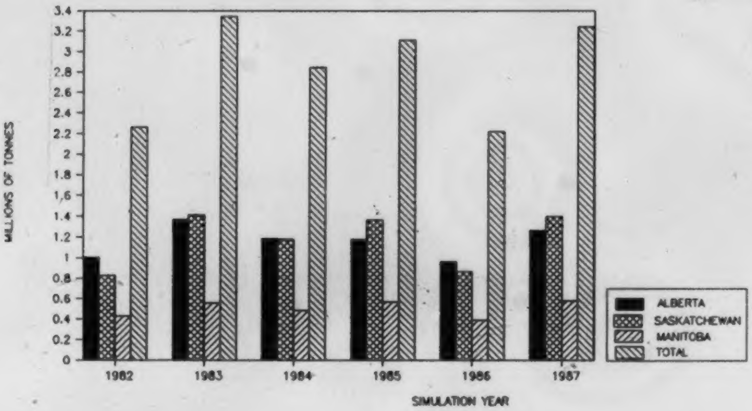


Figure V.6: Adjusted Canola Production - Cost Scenario A-2

2. Adjusted Producer Surplus (1982 - 1987)

Table V.10 illustrates provincial producer surplus levels following production adjustments (current West Coast capacity levels) under cost scenario A-1. The results indicate that estimated producer surplus would vary between 1.52 and 2.58 billion dollars for all grain commodities. This represents approximately a 1 to 4 percent increase in welfare to grain producers in western Canada when compared to baseline producer surplus levels during 1983 and 1986 crop years. Over the remaining crop years producer surplus would decrease between 1 and 4 percent.

Wheat and barley producers in Alberta through the new C.W.B. pricing mechanism, given cost savings estimated under scenario A-1, would receive increases in net returns reflecting locational advantage to West Coast ports. Depending upon marketing and production conditions during any crop year over the simulated period, Alberta's primary barley producers would receive an increase in net returns between 1.2 and 5.27 million dollars as opposed to a 5.85 to 8.17 million dollar increase in wheat returns. Canola returns in Alberta would decrease by a marginal 0.06 to 0.25 percent.

Saskatchewan barley producers because of the new C.W.B. pricing alternative and estimated cost savings under scenario A-1 would receive changes in net returns to a maximum of 644 thousand dollars and decreases by as much as 945 thousand dollars. This change in producer surplus would result because of the elastic barley supply function in Saskatchewan. With the increase in initial prices to wheat producers offsetting the increase in transportation charges, net returns would increase between 16.3 to 96.3 million dollars in Saskatchewan. Also, canola returns would increase between 837 thousand dollars to 7.8 million dollars during the simulated period with calculated cost savings determined in scenario A-1.

Net returns to canola producers located in Manitoba would increase because of the change in grain pricing, along with actual production and marketing conditions representing West Coast capacity. This increase would range from 31 to 366 thousand dollars over the simulated period. During 1984 and 1987 canola returns decreased by 92 and 98 thousand dollars. Further, net returns to Manitoba wheat and barley producers would decline under St. Lawrence/Vancouver pricing with estimated cost savings in scenario A-1. The spread in these decreases range from 3.07 to 7.8 million dollars from wheat sales and 2.8 to 5.31 million dollars for barley producers.

TABLE V.10: PRODUCER SURPLUS - COST SCENARIO A-1 (1982 - 1987)

('000 DOLLARS)

	CROP YEAR					
CROP	82/83	83/84	84/85	85/86	86/87	87/88
ALBERTA						
Barley	260469	173705	211904	202678	174042	65324
Wheat	527282	493864	443498	366890	364629	234644
Canola	103222	221470	171726	187559	101333	189994
SASKATCHEWAN						
Barley	189023	140005	183961	196201	91676	59247
Wheat	970442	821311	789068	629926	708138	405700
Canola	169565	379955	300514	369848	129758	276936
MANITOBA						
Barley	72973	52692	68159	71206	36053	21699
Wheat	252317	214358	245186	298998	224310	176586
Canola	37630	72834	60137	105801	41525	94537
PRAIRIES						
Total	2583423	2570194	2474153	2429107	1647154	1524667

Adjusting wheat and barley initial prices by the cost savings with current West Coast capacity levels under scenario A-2, gives rise to new producer surplus levels, shown in Table V.11. Overall, under the new cost savings, producer welfare from grain sales would range from 1.56 to 2.73 billion dollars over the simulated period. Producer welfare to grain producers, given the cost savings under scenario A-2, would increase a further 2.27 to 13.3 percent over producer welfare measures under the scenario with A-1 cost savings.

Higher cost savings under scenario A-2 results in larger provincial impacts. In Alberta, net returns to producers from wheat sales would increase between 5.54 to 13.25 percent, whereas, barley returns would increase by 0.51 to 5.41 percent, when compared to baseline producer welfare measures. Canola returns would continue to decline, 1.32 to 3.81 percent.

Saskatchewan wheat producers' calculated cost savings in scenario A-2 indicate an increase in net returns over baseline levels by approximately 9.03 to 23.96 percent. The increase in canola returns in Saskatchewan is marginal, approximately 0.003 to 5.64 percent. Barley returns to Saskatchewan producers would decrease by 0.28 to 2.66 percent over the magnitudes found in the baseline scenario.

Wheat producers located in Manitoba are estimated to experience an increase in net returns by 1.7 to 6.99 percent. Barley returns to Manitoba producers remain similar to those decreases found under scenario A-1, 2.33 to 11.5 percent. Over the simulated period Manitoba canola producers could have experienced a decrease amounting to 2.32 percent in returns and an increase of 0.98 percent, if the C.W.B. had implemented their new proposal and cost savings were equivalent to those under scenario A-2.

TABLE V.11: PRODUCER SURPLUS - COST SCENARIO A-2 (1982 - 1987)

('000 DOLLARS)

CROP YEAR

CROP	82/83	83/84	84/85	85/86	86/87	87/88
ALBERTA						
Barley	267845	171920	217818	202350	173690	65313
Wheat	568877	540168	492992	395067	378701	248662
Canola	103222	217600	165592	181218	98585	187881
SASKATCHEWAN						
Barley	194470	138939	186058	195015	90154	58558
Wheat	1043107	886380	858699	660368	724900	424523
Canola	169565	381529	300242	370982	129837	276842
MANITOBA						
Barley	75085	52692	69966	71692	36053	21696
Wheat	273316	232008	266437	313047	229246	184194
Canola	37630	68662	54047	99237	38773	92441
PRAIRIES						
Total	2733117	2689898	2611851	2488976	1899939	1560110

In summary, the new C.W.B. pricing proposal with cost savings under scenario A-1 would increase returns to Alberta wheat producers by approximately 5.85 to 8.17 million dollars. Returns to barley producers in Alberta would increase between 1.2 to 5.27 million dollars over the simulated period. Cost savings found in cost scenario A-2 results in an increase of approximately 19.84 to 57.67 million dollars in wheat returns within the province of Alberta. Further under scenario A-1, net returns for wheat in Saskatchewan will increase by 16.3 to 96.3 million dollars over the simulated period and 35.16 to 165.96 million dollars under scenario A-2. Canola in Saskatchewan is estimated to increase under both cost scenarios by 0.34 to 7.76 million dollars.

Barley producers in Manitoba would experience a decline over the simulated period and under both cost scenarios, by approximately 2.8 to 5.31 million dollars under cost scenario A-1 and 1.79 to 3.60 million dollars under cost scenario A-2.. Wheat returns in Manitoba under calculated savings in scenario A-1 would have decreased by 3.07 to 7.8 million dollars over the simulated period. Returns to Manitoba wheat producers is estimated to increase under savings found in scenario A-2, 3 to 17 million dollars. Canola returns to Manitoba producers would increase by approximately 0.37 million dollars and decline by approximately 6.3 million dollars under the two cost comparisons over the simulated period.

3. Changes to Consumer Surplus (1982 - 1987)

Historically, the off-board price in western Canada has had to stay competitive with initial prices to producers in order to secure grain flowing into that market. An additional cost or benefit of this policy, therefore, are cost changes to livestock feeding, and consumer purchases of wheat. Table V.9 illustrates the changes in consumer surplus over the simulated period, given the cost savings found in Scenario A-1.

TABLE V.12: A-1 CONSUMER SURPLUS CHANGES (1982 - 1987)						
('000 DOLLARS)						
			CROP YEAR			
CROP	82/83	83/84	84/85	85/86	86/87	87/88
			ALBERTA			
Barley	4651	(3995)	(7732)	(6291)	(3293)	(2937)
Wheat	5722	(7107)	(10820)	(6720)	(9216)	(6616)
			SASKATCHEWAN			
Barley	(1086)	(478)	(1760)	(1568)	119	(267)
Wheat	(478)	(4066)	(6940)	(6579)	(6039)	(6129)
			MANITOBA			
Barley	5474	5655	7881	6143	4908	4757
Wheat	5655	7078	12520	9131	9367	8211
			PRAIRIES			
Total	19939	(2913)	(6851)	(5883)	(4154)	(2986)

With estimated cost savings in scenario A-1, livestock producers in western Canada are estimated to incur decreases in barley feeding costs by as much as 9 million dollars (increase in consumer surplus) and increases amounting to a maximum of 1.7 million dollars. Changes in consumer welfare for purchases of wheat over the simulation period are estimated to decrease by approximately 4.0 to 5.9 million dollars. But, during the 1982-83 crop year this change in consumer surplus for wheat is estimated to increase by 10.9 million dollars under adjusted prices from cost savings in scenario A-1.

Changing the grain pricing mechanism results in a net benefit to the western Canadian grains, oilseeds, and livestock economy of 0.87 to 2.2 billion dollars under cost scenario A-1..[23] This ignores any regional impacts between provincial livestock and grain sectors.

In general, Alberta barley costs to livestock producers are expected to increase after the C.W.B implements their pricing proposal and receives savings equivalent to those in scenario A-1. These increases are estimated to be as much as 7.7 million dollars and are expected to decrease during the 1982-1983 crop year by 4.7 million dollars. Therefore, over the simulated period, a net benefit of 8.4 to 170.7 million dollars would result in Alberta's barley sector.

Consumer surplus for wheat is estimated to decrease by 10.8 million dollars and increase by approximately 5.7 million dollars in Alberta, over the simulated period. The net benefit in Alberta's wheat sector is estimated to be larger than the benefit estimated for the barley sector. In fact, net welfare for Alberta's wheat sector would range between 11.8 to 769.5 million dollars, after the C.W.B implements its new pricing proposal and receives cost savings in scenario A-1.

Total welfare in the Alberta grain, oilseed, and livestock sectors are estimated to increase after the cost savings adjustments in scenario A-1, which were brought about by a change in the grain pricing mechanism. This benefit would range between 20.3 to 877.94 million dollars over the simulated period.

In Saskatchewan, it is estimated consumer surplus for barley would increase by approximately 0.2 to 1.8 million dollars, whereas welfare to consumers purchasing wheat would decrease by 0.48 to 6.9 million dollars, over the simulated period. This indicates a benefit to livestock producers purchasing barley in Saskatchewan. The net benefit to Saskatchewan's grain, oilseed, and livestock sectors is estimated to be 58.30 million to 1.1 billion dollars, if cost savings obtained are those under scenario A-1 from 1982 to 1987.

The greatest benefit to livestock producers was estimated to be in Manitoba where consumer surplus for barley increased by 4.9 and 7.9 million dollars, from 1982 through 1987. Change in consumer surplus for wheat in Manitoba increased by 5.6 to 12.5 million dollars, after adjustments for cost savings in scenario A-1. The net benefit for Manitoba's grain, oilseed, and livestock sector varied between 8 and 363 million dollars.

---

[23] This net benefit is derived by adding changes in producer surplus to the changes in consumer surplus.

Table V.13 shows changes to consumer surplus on a provincial basis under cost scenario A-2 (increased capacity at West Coast ports under the new C.W.B. pricing proposal). Given these cost savings and consumer surplus changes, livestock producers in western Canada could have benefited 1.5 to 10.8 million dollars, if the C.W.B. had implemented their pricing proposal between 1982 to 1987. On an aggregate level, consumer surplus changes indicate gains to consumers in the wheat sector of approximately 178.6 to 241.5 million dollars over the simulated period. The grains and livestock sectors within western Canada would incur a net benefit of 192.20 million to 3.2 billion dollars after the introduction of St. Lawrence/Vancouver pricing and C.W.B. cost savings in pool accounts amounted to those in scenario A-2.

TABLE V.13: A-2 CHANGES IN CONSUMER SURPLUS (1982 - 1987)

('000 DOLLARS)

	CROP YEAR					
CROP	82/83	83/84	84/85	85/86	86/87	87/88
ALBERTA						
Barley	13641	(3957)	(14892)	(8085)	(3283)	(2917)
Wheat	47734	(52468)	(78319)	(40020)	(36039)	(23539)
SASKATCHEWAN						
Barley	(5336)	(528)	(5507)	(2633)	62.9	(289)
Wheat	(52762)	757566	(136284)	(84097)	(65399)	(49788)
MANITOBA						
Barley	2523	5655	5210	5422	4763	4763
Wheat	(16261)	(23227)	(26855)	(20633)	(5992)	(5535)
PRAIRIES						
Total	(10461)	683041	(256647)	(150046)	(105887)	(77305)

With the use of cost savings in scenario A-2, it was estimated that changes in consumer surplus would decrease in Alberta, except during the 1982-83 crop year. Therefore, livestock producers purchasing barley in Alberta could receive a loss when compared to their existing situation. Changes in consumer surplus for barley in Alberta range from 2.9 to 14.9 million dollars, as opposed to 23.5 to 78.3 million dollars for wheat. Net welfare in Alberta is estimated to increase over the simulated period by approximately 110.89 to 994.94 million dollars. This suggests that the C.W.B. pooling change proposal causes a transfer of wealth from consumers to producers within Alberta, when costs savings from increased West Coast shipments (Scenario A-2) are used to adjust regional prices.

Changes in consumer surplus within the province of Saskatchewan are estimated to decrease for both wheat and barley purchases. Exceptions to this, occur for barley during the 1985-1986 crop year, and for wheat during the 1983-1984 crop year. Changes in consumer surplus for barley decrease by approximately 0.29 to 5.5 million dollars, and 49.8 to 136.2 million dollars for wheat. Therefore, under the new pricing mechanism, consumers transfer wealth to producers. Net welfare for all grains and oilseeds range from a low of $78.6 million to a high of $1 billion, over the simulated period in the province of Saskatchewan.

Consumers, ie. livestock producers, in the province of Manitoba, benefit by the introduction of a new C.W.B. pricing mechanism. This benefit ranges from 2.5 to 5.7 million dollars over the simulated period. Changes in consumer surplus within the province of Manitoba would decrease between 5.5 and 26.8 million dollars. Net welfare within the grains economy in Manitoba is estimated to be 2.69 to 439.42 million dollars. The result is that barley producers transfer wealth to consumers. Within the wheat sector in Manitoba, producers transfer wealth to consumers.

4. Grain Flows (1982-1987)

Figure V.6 illustrates wheat shipping patterns under current production and marketing conditions representing West Coast capacity (ie. the A-1 Scenario). It was estimated that under St. Lawrence/Vancouver pricing with A-1 cost savings, wheat transport patterns remain identical to those wheat movements found in Table V.4. Differences were estimated to occur in the magnitudes of wheat shipped from each province, given a price policy change. In comparison to Table IV.4, marginal shifts in wheat flows would have been experienced if the C.W.B. had implemented its pricing proposal with current production and marketing conditions representing West coast capacity. These changes occur within the province of Alberta, where approximately 24 percent more wheat would be shipped via the East Coast following the price change during the 1983-1984 crop year. Also during the 1985-1986 crop year a shift of approximately 5 percent of Alberta wheat from the West Coast to the East Coast would occur under the C.W.B. proposal. The majority of wheat exports from the province of Alberta was estimated to be transported via the East Coast from 1982 through 1985. Given that St. lawrence charges are higher on barley than wheat, The C.W.B. in minimizing transport costs would ship barley and some wheat through the West Coast until a binding constraint occurs on West Coast shipments.

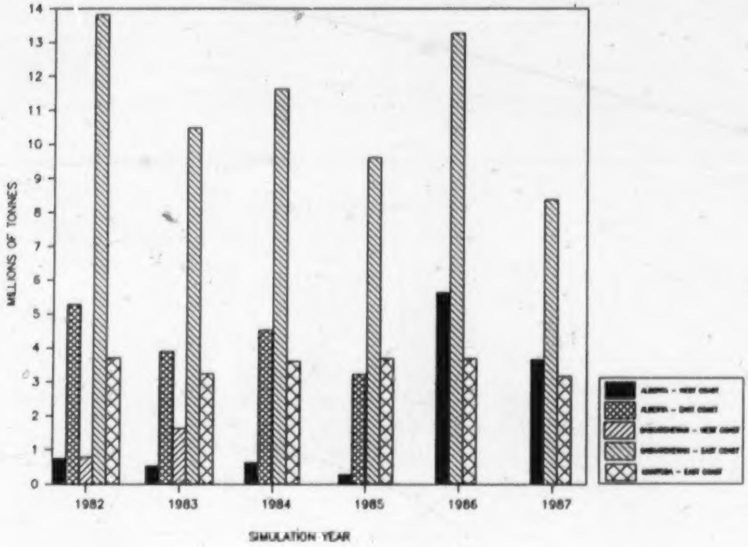


Figure V.6: Wheat Transport Patterns under Cost Scenario A-1

In Figure V.7 barley shipping patterns given A-1 savings are presented on a provincial basis. It was found that changes in barley flows would occur when compared to unadjusted transport patterns under St. Lawrence/Vancouver pricing (Table V.3). During the 1982-83 crop year it was estimated that an increase in Saskatchewan's barley movements of approximately 11.5 percent would be shipped via the East Coast, if competitive conditions were maintained in the western Canadian grains economy. During the 1983-1984 crop year approximately 75 percent of barley shipments from Manitoba would move through the East Coast instead of through Vancouver. It is estimated that in Alberta during the 1984-1985 crop year a shift in barley transport patterns would occur, that is, 24.9 percent of total barley shipments would move through the St. Lawrence via Thunder Bay. It is also estimated that during the 1985-1986 crop year, in Manitoba, 8 percent more barley would be shipped via Thunder Bay. Comparing the results under adjusted barley flows with

St. Lawrence/Vancouver pricing to transport patterns under Thunder Bay/Vancouver pricing shows in general more utilization of the West Coast Ports. In fact during the 1983-1984 crop year approximately 24.9 percent more barley from Manitoba would have been shipped through the West Coast. Also during the 1985-1986 crop year it is estimated that 13.2 percent more barley would have been moved through Vancouver and/or Prince Rupert. An exception to these changes occurs in Alberta during the 1984-1985 crop year where approximately 24.9 percent of barley transport patterns from Alberta would have been shipped through Thunder Bay instead of through West Coast Ports.

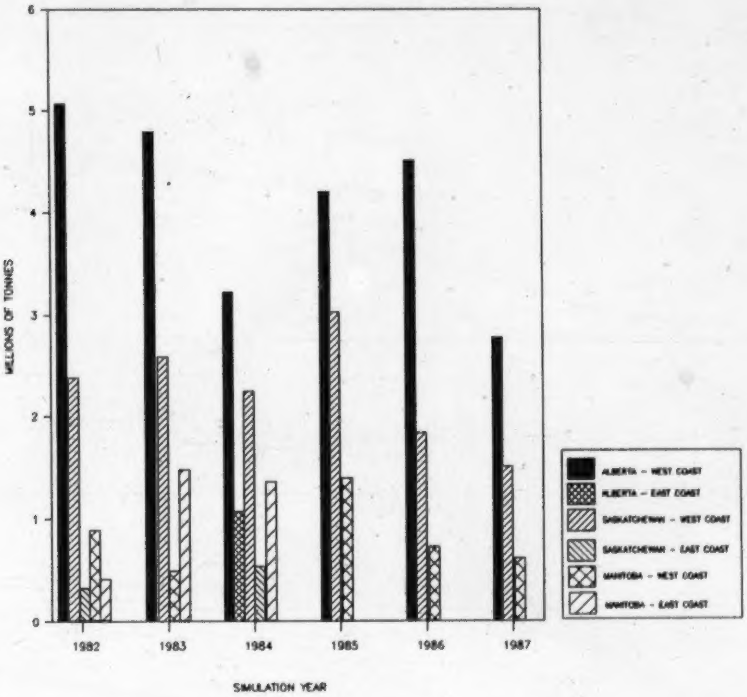


Figure V.7: Barley Transport Patterns under Cost Scenario A-1

Figure V.8 shows adjusted wheat transport patterns on a provincial basis with A-2 cost savings and actual production and marketing conditions at West Coast ports. During the simulated period, approximately 11.7 to 23.5 million tonnes would have been shipped through the East Coast as opposed to 0.40 to 6.5 million tonnes through Vancouver and/or Prince Rupert under A-2 cost savings. Transport patterns for wheat under both cost scenarios (A-1 and A-2) were found to be identical. But the quantities shipped under each cost scenario from the three prairie provinces was estimated to vary.

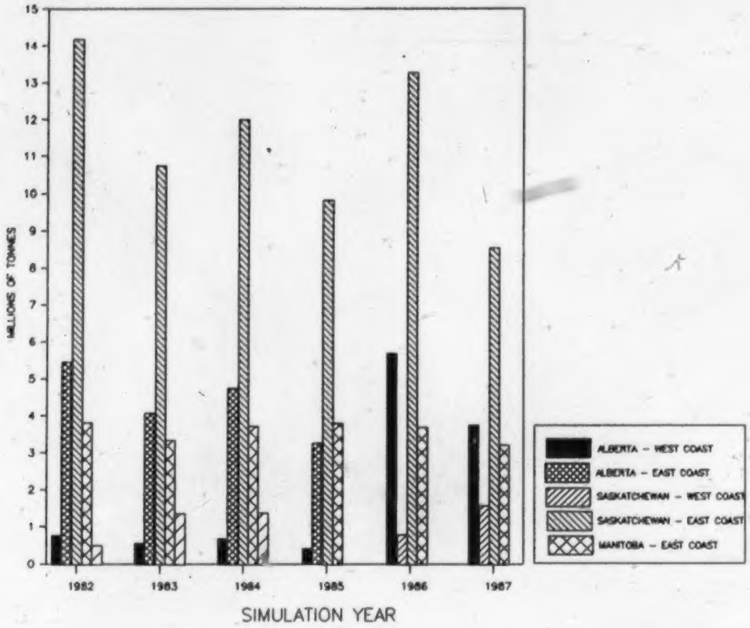


Figure V.8: Wheat Transport Patterns under Cost Scenario A-2

Estimated transport patterns for barley under A-2 cost savings on a provincial basis are in Figure V.9. Over the simulation period it was estimated that approximately 3.4 to 8.2 million tonnes of barley would be shipped through West Coast ports given adjusted provincial exports under A-2 cost savings. During 1982 through 1984 crop years approximately 0.78 to 1.88 million tonnes would have been transported through the St. Lawrence via Thunder Bay. It was found that Thunder Bay would not be a lucrative position for barley exports during the crop years 1985 through 1987. Given estimated provincial barley exports, a shift in shipping patterns during the 1984-1985 crop year from the province of Alberta between cost scenarios A-1 and A-2 was found. This difference indicates that under A-2 savings, all barley in Alberta would be shipped through

West Coast ports, under A-1 savings, 24.9 percent was estimated to be shipped through the Eastern transport system. All remaining barley shipping patterns in Western Canada remain identical for both cost scenarios.

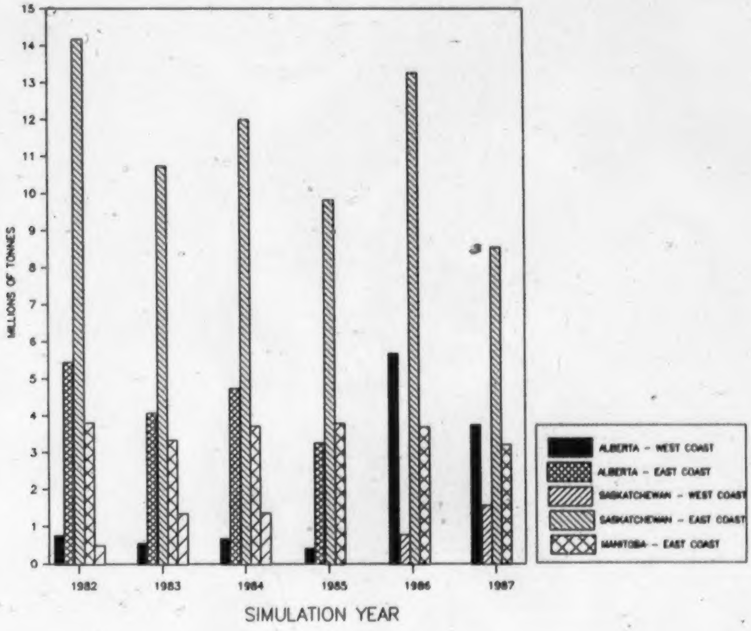


Figure V.9: Barley Transport Patterns under Cost Scenario A-2

5. Freight Costs (1982-1987)

Table V.14 indicates total shipping costs to producers, the C.W.B., and the federal Government given adjusted applicable quantities under St. Lawrence/Vancouver pricing with A-1 cost savings from 1982 to 1987. It is estimated that producers would pay 163.19 to 233.78 million dollars on all grain shipments or $4.65 to $7.34 per tonne. This represents approximately a 10 to 15 percent decrease in total producer freight costs when compared to initial freight costs under St. Lawrence/Vancouver pricing (Table V.6) with actual production and marketing conditions representing West Coast capacity. The approximate decrease in producer transportation costs is estimated to be 18 to 41 million dollars. In comparison to Thunder Bay/Vancouver pricing (Table

IV.6) total producer costs from all grain shipments would be identical to those under St. Lawrence/Vancouver pricing with A-1 cost savings. This is reasonable since aggregate grain shipping patterns remained consistent between Thunder Bay and St. Lawrence/Vancouver pricing.

Canadian Wheat Board costs given A-1 adjusted export quantities are estimated to range between 299.66 and 497.53 million dollars over the simulated period. This represents an increase in C.W.B. shipping costs over unadjusted export quantities under St. Lawrence/Vancouver pricing by approximately 11 to 13 percent or 33 to 49 million dollars. As expected C.W.B. costs would remain equivalent to those found in the baseline scenario (Thunder Bay/Vancouver pricing).

It was estimated that over the simulated period the federal Government's contribution to freight costs would range from 565.13 to 802.70 million dollars. Marginal increases in the total monies allocated by the federal Government in subsidizing grain shipments would increase marginally between the initial and adjusted export quantity case. This increase would range between 3.78 and 15.32 million dollars. In comparing Thunder Bay/Vancouver pricing to adjusted prices under the St. Lawrence proposal, Government grain shipping costs would increase by approximately 0.89 to 6.86 million dollars under cost Scenario A-1. Government contribution towards grain shipments under Scenario A-2 would also increase, by approximately 4.57 to 36.90 million dollars. But during the 1986 crop year government shipping costs would decrease by 1.85 (Scenario A-1) and 0.85 (Scenario A-2) million dollars.

TABLE V.14 ADJUSTED FREIGHT COSTS WITH A-1 SAVINGS

Millions of Dollars (1982-1983)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	29.10	24.46	4.75	0.96	59.27
Saskatchewan	65.39	13.06	4.39	0.32	83.16
Manitoba	13.04	4.54	2.94	0.23	20.76
Total	107.53	42.06	12.07	1.52	163.19
Per Tonne	4.57	4.65	5.38	4.54	4.65
C.W.B. COSTS					
Alberta	105.30	-	-	2.42	107.72
Saskatchewan	263.88	8.17	-	0.74	272.78
Manitoba	70.56	12.72	-	0.72	84.00
Total	439.73	20.89	-	3.88	464.50
Per Tonne	18.70	2.31	-	11.60	13.25
(1983-1984)					
PRODUCER COSTS					
PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
Alberta	23.57	25.13	7.13	1.18	56.99
Saskatchewan	56.75	14.68	8.94	0.49	80.87
Manitoba	12.82	7.78	4.17	0.20	24.97
Total	93.14	47.59	20.24	1.87	162.84
Per Tonne	5.15	5.10	6.09	5.14	5.24
C.W.B. COSTS					
Alberta	78.48	-	-	3.47	81.94
Saskatchewan	208.54	1.69	-	1.26	211.48
Manitoba	64.20	38.03	-	0.73	102.95
Total	351.21	39.71	-	5.45	396.38
Per Tonne	19.41	4.25	-	15.01	12.76
GOVERNMENT COSTS					
Alberta	94.98	86.32	24.47	5.33	211.10
Saskatchewan	192.98	53.83	29.43	1.65	277.88
Manitoba	46.73	32.23	12.14	0.73	91.83
Total	334.68	172.39	66.03	7.71	580.81
Per Tonne	18.49	18.46	19.88	21.22	18.69

...Continued

TABLE V.14 *con't* ADJUSTED FREIGHT COSTS WITH A-1 SAVINGS

Millions of Dollars (1984-1985)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	38.04	31.65	8.58	1.37	79.65
Saskatchewan	87.37	21.34	10.15	0.30	119.16
Manitoba	21.33	8.03	5.29	0.33	34.98
Total	146.73	61.01	24.03	2.00	233.78
Per Tonne	7.21	7.24	8.43	7.10	7.34
C.W.B. COSTS					
Alberta	106.84	-	-	3.31	110.15
Saskatchewan	255.79	15.61	-	0.61	272.00
Manitoba	79.25	35.26	-	0.87	115.37
Total	441.88	50.86	-	4.79	497.53
Per Tonne	21.71	6.03	-	16.96	15.62
GOVERNMENT COSTS					
Alberta	106.10	72.67	19.72	4.11	202.60
Saskatchewan	205.69	52.81	23.25	0.71	282.46
Manitoba	48.81	18.37	12.12	0.76	80.07
Total	360.60	143.85	55.10	5.58	565.13
Per Tonne	17.72	17.06	19.33	19.76	17.74

...Continued

TABLE V.14 *con't* ADJUSTED FREIGHT COSTS WITH A-1 SAVINGS

Millions of Dollars (1985-1986)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	20.16	24.23	6.73	0.87	51.99
Saskatchewan	56.17	18.00	9.02	0.33	83.53
Manitoba	17.26	6.41	4.94	0.35	28.96
Total	93.59	48.64	20.69	1.54	164.47
Per Tonne	5.56	5.65	6.64	5.45	5.72
C.W.B. COSTS					
Alberta	85.37	-	-	2.68	88.06
Saskatchewan	240.58	2.20	-	0.90	243.67
Manitoba	93.68	5.72	-	1.19	100.60
Total	419.63	7.92	-	4.78	432.33
Per Tonne	24.92	0.92	-	16.88	15.02
GOVERNMENT COSTS					
Alberta	91.79	89.02	24.72	4.11	209.64
Saskatchewan	207.08	74.21	33.13	1.21	315.62
Manitoba	63.47	44.57	18.17	1.27	127.47
Total	362.33	207.80	76.02	6.59	652.74
Per Tonne	21.51	24.13	23.29	23.29	22.68

...Continued

TABLE V.14 *con't* ADJUSTED FREIGHT COSTS WITH A-1 SAVINGS

Millions of Dollars (1986-1987)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	32.31	25.94	5.54	1.21	64.99
Saskatchewan	81.36	10.96	5.68	0.41	98.42
Manitoba	17.28	3.40	3.42	0.31	24.41
Total	130.95	40.30	14.64	1.93	187.82
Per Tonne	5.61	5.70	6.54	5.56	5.71
C.W.B. COSTS					
Alberta	-	-	-	3.87	3.87
Saskatchewan	302.06	1.12	-	1.16	304.34
Manitoba	83.98	2.90	-	1.08	87.96
Total	386.04	4.02	-	6.11	396.17
Per Tonne	16.55	0.57	-	17.64	12.04
GOVERNMENT COSTS					
Alberta	134.94	108.30	23.08	6.57	272.89
Saskatchewan	341.11	50.54	23.75	1.72	417.12
Manitoba	70.78	26.33	14.32	1.26	112.69
Total	546.84	185.16	61.16	9.54	802.70
Per Tonne	23.45	26.20	27.32	27.52	24.39

...*Continued*

In Table V.15 adjusted freight costs using A-2 cost savings are presented. It was found that total logistic costs to producers from all grain shipments would range between 154.63 and 239.23 million dollars. In comparison to Thunder Bay/Vancouver pricing, these producer costs indicate an increase of approximately 6.23 and a decrease of 8.37 million dollars.

It was estimated that Canadian Wheat Board costs from all grain shipments under St. Lawrence/Vancouver pricing with A-2 cost savings would range between 305.50 and 514.52 million dollars over the simulated period. This represents an increase in C.W.B. shipping costs by 5.64 to 17.25 million dollars on all grain shipments when compared to the baseline scenario.

Government costs on all grain shipments are estimated to range between 578.86 to 803.70 million dollars from 1982 to 1987. Overall the federal Government contribution towards grain shipments would increase by as much as 24.8 million dollars and decrease by $0.85 million.[24]

---

[24] Adjusted freight costs to the C.W.B. from grain shipments on a sub regional basis are in Appendix B, Tables B-1 and B-2.

TABLE V.14 *con't* ADJUSTED FREIGHT COSTS WITH A-1 SAVINGS

Millions of Dollars (1987-1988)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	22.26	16.87	7.71	1.29	48.12
Saskatchewan	61.36	9.60	11.03	0.43	82.42
Manitoba	15.45	2.99	5.30	0.32	24.06
Total	99.07	29.46	24.04	2.04	154.06
Per Tonne	5.89	6.02	7.00	5.88	6.08
C.W.B. COSTS					
Alberta	-	-	-	4.24	4.24
Saskatchewan	209.87	0.89	-	1.27	212.03
Manitoba	79.52	2.67	-	1.19	83.38
Total	289.39	3.56	-	6.70	299.66
Per Tonne	17.21	0.73	-	19.34	11.79
GOVERNMENT COSTS					
Alberta	84.70	64.20	29.34	6.35	184.59
Saskatchewan	233.96	39.91	41.97	1.66	317.50
Manitoba	58.84	21.59	20.20	1.21	101.84
Total	377.51	125.70	91.50	9.22	603.92
Per Tonne	22.46	25.70	26.64	26.59	23.76

TABLE V.15: ADJUSTED FREIGHT COSTS WITH A-2 SAVINGS

Millions of Dollars (1982-1983)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	30.24	24.67	4.77	0.96	60.64
Saskatchewan	67.24	12.87	4.28	0.32	84.70
Manitoba	13.48	4.61	3.05	0.23	21.37
Total	110.95	42.16	12.09	1.52	166.72
Per Tonne	4.57	4.65	5.39	4.54	4.65
C.W.B. COSTS					
Alberta	109.12	-	-	2.42	111.54
Saskatchewan	271.24	7.50	-	0.74	279.48
Manitoba	72.93	14.69	-	0.72	88.34
Total	453.29	22.19	-	3.88	479.36
Per Tonne	18.69	2.45	-	11.60	13.38

...Continued

TABLE V.15 *con't* ADJUSTED FREIGHT COSTS WITH A-2 SAVINGS

Millions of Dollars (1983-1984)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	25.00	24.83	7.27	1.18	58.27
Saskatchewan	58.40	13.95	8.80	0.49	81.64
Manitoba	13.28	7.78	4.28	0.20	25.55
Total	96.68	46.56	20.35	1.87	165.45
Per Tonne	5.15	5.09	6.09	5.14	5.24
C.W.B. COSTS					
Alberta	82.74	-	-	3.47	86.20
Saskatchewan	214.25	1.51	-	1.26	217.02
Manitoba	66.52	35.65	-	0.73	102.89
Total	363.51	37.15	-	5.45	406.11
Per Tonne	19.37	4.06	-	15.01	12.86
GOVERNMENT COSTS					
Alberta	100.71	85.34	24.95	5.33	216.32
Saskatchewan	198.41	50.85	28.96	1.65	279.87
Manitoba	48.42	33.13	12.47	0.73	94.75
Total	347.54	169.32	66.37	7.71	590.94
Per Tonne	18.52	18.50	19.87	21.22	18.72

...*Continued*

TABLE V.15 *con't* ADJUSTED FREIGHT COSTS WITH A-2 SAVINGS

Millions of Dollars (1984-1985)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	40.29	31.81	8.73	1.37	82.20
Saskatchewan	90.45	20.40	9.88	0.30	121.03
Manitoba	22.12	8.13	5.40	0.33	35.99
Total	152.86	60.35	24.01	2.00	239.23
Per Tonne	7.21	7.23	8.44	7.10	7.33
C.W.B. COSTS					
Alberta	112.42	-	-	3.31	115.73
Saskatchewan	264.78	14.61	-	0.61	280.00
Manitoba	82.20	35.72	-	0.87	118.79
Total	459.40	50.34	-	4.79	514.52
Per Tonne	21.67	6.03	-	16.96	15.77
GOVERNMENT COSTS					
Alberta	112.26	73.03	20.06	4.11	209.46
Saskatchewan	212.94	50.75	22.62	0.71	287.02
Manitoba	50.63	18.62	12.38	0.76	82.38
Total	375.83	142.40	55.06	5.58	578.86
Per Tonne	17.73	17.06	19.34	19.76	17.75

...Continued

TABLE V.15 *con't* ADJUSTED FREIGHT COSTS WITH A-2 SAVINGS

Millions of Dollars (1985-1986)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	21.30	24.05	6.80	0.87	53.02
Saskatchewan	57.44	17.32	8.89	0.33	83.97
Manitoba	17.56	6.43	4.97	0.35	29.30
Total	96.30	47.80	20.67	1.54	166.30
Per Tonne	5.56	5.64	6.64	5.45	5.71
C.W.B. COSTS					
Alberta	86.69	-	-	2.68	89.37
Saskatchewan	245.96	2.05	-	0.90	248.91
Manitoba	95.28	5.74	-	1.19	102.22
Total	427.93	7.80	-	4.78	440.50
Per Tonne	24.71	0.92	-	16.88	15.13
GOVERNMENT COSTS					
Alberta	96.41	88.37	24.99	4.11	213.88
Saskatchewan	211.75	71.15	32.64	1.21	316.75
Manitoba	64.55	44.73	18.28	1.27	128.82
Total	372.71	204.24	75.91	6.59	659.45
Per Tonne	21.52	24.11	24.39	23.29	22.66

...Continued

TABLE V.15 *con't* ADJUSTED FREIGHT COSTS WITH A-2 SAVINGS

Millions of Dollars (1986-1987)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	32.81	25.82	5.55	1.21	65.40
Saskatchewan	81.75	10.52	5.62	0.41	98.29
Manitoba	17.36	3.40	3.41	0.31	24.47
Total	131.92	39.74	14.57	1.93	188.16
Per Tonne	5.62	5.70	6.54	5.56	5.71
C.W.B. COSTS					
Alberta	-	-	-	3.87	3.87
Saskatchewan	303.11	1.03	-	1.16	305.29
Manitoba	84.37	2.90	-	1.08	88.35
Total	387.48	3.92	-	6.11	397.52
Per Tonne	16.49	0.56	-	17.64	12.06
GOVERNMENT COSTS					
Alberta	137.05	107.80	23.16	6.57	274.58
Saskatchewan	342.72	48.27	23.47	1.72	416.18
Manitoba	71.12	26.33	14.25	1.26	112.94
Total	550.88	182.40	60.87	9.54	803.70
Per Tonne	23.45	26.17	27.31	27.52	24.37

...Continued

TABLE V.15 *con't* ADJUSTED FREIGHT COSTS WITH A-2 SAVINGS

Millions of Dollars (1987-1988)

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER COSTS					
Alberta	23.00	16.77	7.77	1.29	48.81
Saskatchewan	62.33	9.16	9.56	0.43	81.48
Manitoba	15.68	2.99	5.34	0.32	24.33
Total	101.00	28.93	22.67	2.04	154.63
Per Tonne	5.90	6.02	7.00	5.88	6.07
C.W.B. COSTS					
Alberta	-	-	-	4.24	4.24
Saskatchewan	214.60	0.80	-	1.27	216.68
Manitoba	80.72	2.67	-	1.19	84.58
Total	295.32	3.48	-	6.70	305.50
Per Tonne	17.24	0.72	-	19.34	12.00
GOVERNMENT COSTS					
Alberta	87.49	63.82	29.55	6.35	187.21
Saskatchewan	237.66	37.94	36.38	1.66	313.63
Manitoba	59.73	21.58	20.35	1.21	102.87
Total	384.87	123.34	86.28	9.22	603.71
Per Tonne	22.46	25.66	26.63	26.59	23.71

VI. PAY THE PRODUCER ALTERNATIVE

Producer freight rates under the current W.G.T.A. do not reflect the direction of grain flows in western Canada. Consequently, additional costs are borne by the C.W.B. through pool accounts, and the federal Government. These increased costs to the C.W.B. because of this freight rate distortion are pooled amongst all western grain producers. The impact of price pooling under a different freight rate policy (producers paying full transportation charges) would reflect the direction of grain shipments and the location of a producer to the export market, while at the same time decreasing these additional costs to the C.W.B. and the Federal Government. Any changes that occur in production and shipments because of a different method of payment are therefore analyzed in this section.

A. Baseline Analysis

1. Production Responses (1983-1987)

Table VI.1, indicates initial production levels, under the scenario that producers pay full W.G.T.A. freight rate charges without any compensation (pay the producer).[25] Grain production is estimated to vary between 24.5 to 32 million tonnes under Thunder Bay/Vancouver pricing, while producer freight rates reflect the full cost of transportation. This represents a decrease of approximately 5 (1.68 million tonnes) to 9.72 (2.64 million tonnes) percent over initial production levels in the baseline run (pay the railway). The major decline occurs in barley production. It was found that barley production in Alberta over baseline levels would decline by 9.98 (527.65 thousand tonnes) to 18.19 (677.75 thousand tonnes) percent, if there was a method of payment change, that is, producers pay full transportation costs. The largest decrease in Alberta barley production, in terms of magnitude, occurred during the 1986 crop year, by approximately 744.93 thousand tonnes. In Saskatchewan this decrease in barley production is estimated to have a wider range, from 10.14 (308.42 thousand tonnes) to 27.10 (563.11 thousand tonnes) percent from 1983 to 1987. Manitoba barley production over the simulated period under this scenario is estimated to decrease by 10.44 (220.25 thousand tonnes) to 21.81 (301.57 thousand tonnes) percent. The other major decline occurs in Alberta wheat production, by approximately 6.40 (325.37 thousand tonnes) to 12.09 (416.30 thousand tonnes) percent. Saskatchewan wheat production falls by 3.68 (516 thousand tonnes) to 5.92 (619.6 thousand tonnes) percent. The impacts on Manitoba wheat production are similar to those found for Saskatchewan. In fact wheat production in Manitoba would decrease over baseline simulated crop production results, by approximately 3.13 (114.44 thousand tonnes) to 6.30 (204.93 thousand tonnes) percent. Canola production in western Canada decreases marginally over the simulated period.

---

[25] Full W.G.T.A. freight charges represent producer share plus the federal Governments contribution towards grain shipments to export position.

TABLE VI.1: SIMULATED CROP PRODUCTION (1983-1987)

('000 TONNES)

CROP YEAR

PAY THE PRODUCER - THUNDER BAY/VANCOUVER PRICING

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	4032.60	4758.20	4558.00	4737.40	3048.30
Wheat	3926.00	4761.00	3028.50	5110.90	3166.10
Canola	1297.90	1127.60	1130.90	922.90	1220.50
SASKATCHEWAN					
Barley	2198.40	2733.80	2774.30	1828.50	1514.80
Wheat	9840.20	11487.2	9106.20	13502.6	9515.60
Canola	1449.90	1179.50	1374.90	863.90	1394.10
MANITOBA					
Barley	1767.60	1889.40	1865.20	1177.70	1081.00
Wheat	3045.70	3542.40	3595.20	3532.50	3043.20
Canola	506.00	464.60	547.50	375.00	561.10
PRAIRIES					
Total	28064.30	31943.70	27980.70	32051.40	24544.70

2. Producer Surplus (1983-1987)

In Table VI.2 producer surplus under the method of payment change is presented. The results indicate that producer surplus would vary between 1.1 and 2.0 billion dollars, over the simulated period. This represents a decrease in producer welfare over the baseline analysis (pay the railway). The approximate magnitude of this decrease ranges between 316 and 462 million dollars given estimated grain production in western Canada from 1983 to 1987. The major impact is in wheat production where producer welfare would decrease by approximately 171.93 to 320.67 million dollars. Producer welfare for barley production in western Canada would decline by 88.21 to 162.9 million dollars, as opposed to a 43.6 to 69.98 million dollar decrease in welfare for canola producers.

Producer welfare would decrease over baseline levels for each province and for each crop. For instance, producer welfare for barley producers decreases by 35.2 to 72.3 million dollars in Alberta, and 40.1 to 74.0 million dollars in Saskatchewan. Manitoba barley producers welfare would decrease by approximately 12.8 to 22.28 million dollars over the simulated period. This implies that a benefit to livestock producers through purchases of barley may exist in western Canada.

Net returns or producer welfare for wheat producers located in Saskatchewan would decrease by 65.14 to 175.25 million dollars over the simulated period if producers were to pay the total cost of grain transportation. In Alberta this decline ranges between 73.8 and 102.4 million dollars. Manitoba wheat producers would experience marginal decreases in returns when compared to Alberta and Saskatchewan, of 26.78 to 43.27 million dollars.

Canola producers located in Saskatchewan would experience the largest decrease in canola returns if the federal government implemented a method of payment change in western Canada. This decrease is estimated from the production simulation sub model to range from 31.88 to 44.69 million dollars. Alberta returns from canola sales would decrease by approximately 9.6 to 18.1 million dollars. Manitoba canola producers would also experience a decline in returns by approximately 0.76 to 10.5 million dollars.

TABLE VI.2: SIMULATED PRODUCER SURPLUS (1983-1987)

('000 DOLLARS)

CROP YEAR

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	106184.4	153007.5	132914.7	100468.3	28613.6
Wheat	386214.7	355316.0	271375.7	256390.9	155055.1
Canola	203466.0	162514.1	173824.7	87947.0	173307.7
SASKATCHEWAN					
Barley	89006.6	138777.8	121495.1	38748.5	19757.6
Wheat	599231.2	627598.3	473390.1	516905.1	279669.8
Canola	347168.7	266486.0	323653.1	99514.6	232293.2
MANITOBA					
Barley	40064.3	55582.9	53046.1	22112.0	11725.3
Wheat	179544.5	226213.2	259912.5	186547.1	147133.8
Canola	62076.0	59472.9	98627.1	35525.6	85959.5
PRAIRIES					
Total	2012956.4	2044968.7	1908239.1	1344159.1	1133516

3. Changes in Consumer Welfare (1983-1987)

Consumers in the grain industry would benefit from a method of payment change to producers (Table VI.3). It is estimated that the consumer benefit for all grains would be approximately 507.5 to 903.3 million dollars over the baseline (pay railway) simulated levels.

Consumer surplus increases for each crop and province over the simulated period. For example, in Alberta, livestock producers could gain as much as 88.3 to 141.9 million dollars, from the price change. In Saskatchewan this benefit is estimated to cause a 40.4 to 77.8 million dollar benefit to consumers in barley purchases. This benefit is approximated to be 22.4 to 33.6 million dollars in Manitoba.

The greatest impact of a method of payment change occurs to consumers for wheat in Saskatchewan. This benefit is estimated to be 144.4 to 376.18 million dollars. Consumers in Alberta purchasing wheat could experience a 61.4 to 115.7 million dollar benefit, whereas consumers in Manitoba would benefit by 45.9 to 72.6 million dollars.

Over the simulated period, consumers purchasing canola in Alberta would benefit 22.2 to 42.6 million dollars. In Saskatchewan this benefit is approximately 25.5 to 39.3 million dollars and 18 to 26.6 million dollars in Manitoba.

TABLE VI.3: CHANGES IN CONSUMER SURPLUS, (1983-1987)

('000 DOLLARS)

CROP YEAR

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	88371.6	97313.9	112505.1	141995.1	91215.8
Wheat	72427.5	74422.4	61375.9	115660.2	80233.2
Canola	22172.7	29916.2	37477.5	37705.7	42600.8
SASKATCHEWAN					
Barley	56598.4	40438.5	76479.9	77783.9	58143.9
Wheat	218430.3	144377.9	224441.7	376181.8	272490.8
Canola	28221.8	25542.3	38493.3	29643.2	39316.6
MANITOBA					
Barley	26409.2	26846.1	33563.3	25125.4	22385.9
Wheat	45857.4	50675.5	64738.0	72621.9	60975.8
Canola	18529.2	17980.0	26432.6	26614.9	26614.9
PRAIRIES					
Total	577018.1	507512.8	675507.3	903332.1	693977.7

Summing the change in producer surplus between the baseline analysis under the two methods of payments (Table V. and Table VI.2) and the change in consumer surplus (Table VI.3) will give a measure for net welfare. The result from these calculations indicate a net benefit to the western Canadian grains and oilseed economy of approximately 212.75 to 432.84 million dollars.

Although in total there is a net benefit to the grains and oilseed economy, provincial impacts are dissimilar in some cases. For instance, the wheat sector within Alberta would experience decreases in welfare during the 1984 and 1985 crop years. The Saskatchewan canola economy would also experience decreases in welfare. Therefore, in these economies the decrease in producer surplus is greater than the gain in consumer surplus. In the remaining sectors, it was found that there would be a transfer of wealth from producers to consumers if a change in the method of payment is implemented.

4. Optimal Grain Shipment Patterns (1983-1987)

Table VI.4 shows optimal grain shipment patterns on a provincial basis under a pay the producer alternative with current capacity as a West Coast constraint. If a method of payment change is implemented under current marketing and production conditions during the simulated period, approximately 29 to 59 percent of western Canadian grain exports would be shipped through Vancouver and/or Price Rupert ports. In comparison to the baseline results in Table IV.4, marginal changes are estimated to occur in shipment patterns, that is, if competitive conditions are to be maintained and producer freight rates reflect the total cost of transportation. These marginal changes would result in more Alberta grain being shipped via West Coast ports, whereas, shifts in Saskatchewan and Manitoba shipments would favor the East Coast port.

TABLE VI.4: BASELINE GRAIN FLOWS UNDER TOTAL COSTING

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
11.7 MILLION TONNE WEST COAST CONSTRAINT (1983-1984).						
WEST COAST						
ALBERTA	3.93	3.13	1.30	0.05	8.41	97.91
SASKATCHEWAN	-	1.34	1.45	-	2.79	21.35
MANITOBA	-	-	0.51	-	0.51	11.04
TOTAL	3.93	4.47	3.26	0.05	11.70	44.54
EAST COAST						
ALBERTA	-	-	-	0.18	0.18	2.09
SASKATCHEWAN	9.84	0.35	-	0.09	10.28	78.65
MANITOBA	3.05	1.01	-	0.05	4.11	88.96
TOTAL	12.89	1.36	-	0.32	14.57	55.46
10 MILLION TONNE WEST COAST CONSTRAINT (1984-1985).						
WEST COAST						
ALBERTA	3.37	3.71	1.13	0.15	8.36	85.31
SASKATCHEWAN	-	-	1.18	-	1.18	7.77
MANITOBA	-	-	0.46	-	0.46	8.76
TOTAL	3.37	3.71	2.77	0.15	10.00	33.07
EAST COAST						
ALBERTA	1.40	-	-	0.04	1.44	14.69
SASKATCHEWAN	11.49	2.48	-	0.04	14.01	92.23
MANITOBA	3.54	1.19	-	0.06	4.79	91.24
TOTAL	16.43	3.67	-	0.14	20.24	66.93
12 MILLION TONNE WEST COAST CONSTRAINT (1985-1986).						
WEST COAST						
ALBERTA	3.03	3.50	1.13	0.02	7.68	98.34
SASKATCHEWAN	1.59	0.81	1.37	-	3.77	13.27
MANITOBA	-	-	0.55	-	0.55	10.24
TOTAL	4.62	4.31	3.05	0.02	12.00	28.84
EAST COAST						
ALBERTA	-	-	-	0.13	0.13	1.66
SASKATCHEWAN	7.52	17.07	-	0.06	24.65	86.73
MANITOBA	3.60	1.15	-	0.07	4.82	89.76
TOTAL	11.12	18.22	-	0.26	29.60	71.16

...Continued

Increasing West Coast capacity to 20 million metric tonnes under a pay the producer method of payment enables approximately 45 to 88 percent of total grain shipments to be allocated to the West Coast ports (Table VI.4). Over the simulation period it was estimated that there would be a 60:40 west/east split in transport patterns. But during the 1983-1984 crop year, transport patterns between the two constraint levels are equivalent. Since there are changes in transport patterns by relaxing West Coast export restrictions under a method of payment to producers, total

TABLE V.4: con't BASELINE GRAIN FLOWS UNDER TOTAL COSTING

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
15.7 MILLION TONNE WEST COAST CONSTRAINT (1986-1987).						
WEST COAST						
ALBERTA	5.11	3.76	0.92	0.21	10.00	100.0
SASKATCHEWAN	3.17	1.28	0.90	-	5.35	33.97
MANITOBA	-	-	0.37	-	0.37	8.35
TOTAL	8.28	5.04	2.19	0.21	15.70	52.06
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	10.33	-	-	0.07	10.40	66.03
MANITOBA	3.53	0.46	-	0.07	4.06	91.65
TOTAL	13.86	0.46	-	0.14	14.46	47.94
13.4 MILLION TONNE WEST COAST CONSTRAINT (1987-1988).						
WEST COAST						
ALBERTA	3.17	2.07	1.22	0.21	6.67	100.0
SASKATCHEWAN	3.78	0.99	1.39	-	6.16	51.51
MANITOBA	-	-	0.56	-	0.56	13.90
TOTAL	6.95	3.06	3.17	0.21	13.40	59.11
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	5.73	-	-	0.07	5.80	48.49
MANITOBA	3.04	0.36	-	0.07	3.47	86.10
TOTAL	8.77	0.36	-	0.14	9.27	40.89

transportation costs to the grain system may be alleviated. In terms of tonnages this cost reduction would be equivalent to the difference in the two constraint levels assigned to Prince Rupert and/or Vancouver ports.

TABLE VI.5: BASELINE GRAIN FLOWS - INCREASED CAPACITY

Millions of Tonnes (1983-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
1983-1984						
WEST COAST						
ALBERTA	3.93	3.13	1.30	0.05	8.41	97.90
SASKATCHEWAN	-	1.34	1.45	-	2.79	21.38
MANITOBA	-	-	0.51	-	0.51	11.04
TOTAL	3.93	4.47	3.26	0.05	11.71	44.59
EAST COAST						
ALBERTA	-	-	-	0.18	0.18	2.10
SASKATCHEWAN	9.84	0.33	-	0.09	10.26	78.62
MANITOBA	3.05	1.01	-	0.05	4.11	88.96
TOTAL	12.89	1.34	-	0.32	14.55	55.41
1984-1985						
WEST COAST						
ALBERTA	4.76	3.71	1.13	0.15	9.75	99.59
SASKATCHEWAN	6.90	1.67	1.18	-	9.75	64.19
MANITOBA	-	-	0.46	-	0.46	8.76
TOTAL	11.66	5.38	2.77	0.15	19.96	66.03
EAST COAST						
ALBERTA	-	-	-	0.04	0.04	0.41
SASKATCHEWAN	4.59	0.81	-	0.04	5.44	35.81
MANITOBA	3.54	1.19	-	0.06	4.79	91.24
TOTAL	8.13	2.00	-	0.14	10.27	33.97
1985-1986						
WEST COAST						
ALBERTA	3.03	3.50	1.13	0.15	7.81	100.0
SASKATCHEWAN	4.19	2.13	1.37	0.01	7.70	50.00
MANITOBA	-	-	0.55	-	0.55	10.24
TOTAL	7.22	5.63	3.05	0.16	16.06	61.23
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	4.91	0.39	-	0.05	5.35	50.00
MANITOBA	3.60	1.15	-	0.07	4.82	89.76
TOTAL	8.51	1.54	-	0.12	10.17	38.77

...Continued

TABLE VI.5: con't BASELINE GRAIN FLOWS UNDER TOTAL COSTING

Millions of Tonnes (1983-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
1986-1987						
WEST COAST						
ALBERTA	5.11	3.76	0.92	0.21	9.79	100.0
SASKATCHEWAN	7.47	1.28	0.87	-	9.62	61.20
MANITOBA	-	-	0.37	-	0.37	8.35
TOTAL	12.58	5.04	2.16	0.21	19.78	66.06
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	6.03	-	-	0.07	6.10	38.80
MANITOBA	3.53	0.46	-	0.07	4.06	91.65
TOTAL	9.56	0.46	-	0.14	10.16	33.94
1987-1988						
WEST COAST						
ALBERTA	3.17	2.07	1.22	0.21	6.67	100.0
SASKATCHEWAN	9.51	0.99	1.39	0.07	11.96	100.0
MANITOBA	0.44	0.36	0.56	-	1.36	33.66
TOTAL	13.12	3.42	3.17	0.28	20.00	88.18
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	-	-	-	-	-	-
MANITOBA	2.61	-	-	0.07	2.68	66.34
TOTAL	2.61	-	-	0.07	2.68	11.82

5. Shipping Costs (1983-1987)

Grain shipping costs to producers, the C.W.B., and the federal Government, are broken down on a provincial basis in Table VI.5. It was found that with West Coast capacity equivalent to current production and marketing conditions, producers on average would pay approximately 610 to 889 million dollars on all grain shipments over the simulated period. This represents a decrease in farm gate returns for all grain by the amount of the transportation cost, i.e. by approximately $23.28/tonne to $34.61/tonne. Producers in western Canada would find an increase over existing transportation costs (baseline analysis) of approximately 458 to 701 million dollars, or $16.84/tonne to $28.54/tonne. Except for the 1985-1986 crop year, the bulk of producer costs would occur on wheat shipments. In the 1985-1986 crop year barley freight costs contributes the greatest to total producer costs in Alberta, while Manitoba and Saskatchewan wheat shipments would continue to represent a major component of total costs.

On average the Canadian Wheat Board, given optimal grain shipments, would deduct from pool accounts approximately 298 to 782 million dollars, if the federal Government implemented a method of payment change in western Canada. This represents a range varying between $11.17/tonne to $15.73/tonne over the simulation period. The bulk of these costs would continue to occur on Saskatchewan wheat exports, 188 to 259 million dollars from 1983 to 1987. If the C.W.B. act was changed so that producer freight rates would reflect total transportation charges, the C.W.B. would deduct additional per tonne shipment charges amounting to 5.8 to 19.4 percent, when compared to baseline results. But, during the 1985-1986 crop year, increases in pool accounts could result, amounting to 0.76 percent over the findings in Table VI.6. Also, during the 1987-1988 crop year under estimated transport patterns with actual production and marketing conditions representing West Coast capacity, C.W.B. costs over baseline results could decrease by as much as 19.4 percent on all tonnes transported.

Total logistics costs to the western Canadian grains industry are estimated to range between 909 million and 1.2 billion dollars over the simulated period under a method of payment change. On a per tonne basis, transport costs to the system would vary between $40 and $49 dollars. In comparison, total system cost for aggregate grain shipments (total tonnages) under the baseline analysis are greater than those found under a change in the method of payment to producers. This decrease is attributed to less grain being exported in western Canada under the proposed change in producer transport charges. But per tonne changes in system costs resulting from grain shipments are greater under the total costing approach.

TABLE VI.6: TRANSPORT COSTS: PAY THE PRODUCER SCENARIO

(1983-1987)

MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1983-1984					
Producer					
Wheat	92.23	233.48	56.16	381.87	22.71
Barley	72.93	41.40	18.70	133.02	22.81
Canola	30.70	38.59	17.76	87.05	26.75
Oats	5.25	2.13	0.94	8.32	22.89
Total	201.11	315.59	93.56	610.25	23.28
C.W.B.					
Wheat	-	196.50	60.55	257.05	15.29
Barley	-	10.80	24.96	35.76	6.13
Oats	3.48	1.31	0.73	5.51	15.18
Total	3.48	208.62	86.24	298.33	11.38
System					
Wheat	92.23	429.98	116.71	638.92	38.00
Barley	72.93	52.20	43.66	168.78	28.95
Canola	30.70	38.59	17.77	87.05	26.75
Oats	8.73	3.44	1.66	13.83	38.07
Grand Total	204.55	524.21	179.79	908.58	34.67

...Continued

TABLE VI.6: ***Con't*** **TRANSPORT COSTS: PAY THE PRODUCER SCENARIO**

(1983-1987)

MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1984-1985					
Producer					
Wheat	116.09	284.46	68.97	469.52	23.72
Barley	90.32	62.60	23.12	176.04	23.86
Canola	27.49	32.46	17.12	77.07	27.81
Oats	4.53	0.99	1.09	6.61	23.39
Total	238.42	380.51	110.31	729.24	24.17
C.W.B.					
Wheat	38.25	258.82	77.93	375.00	18.95
Barley	-	66.25	30.88	97.13	13.16
Oats	0.98	0.65	0.87	2.49	8.82
Total	39.23	325.72	109.68	474.63	15.73
System					
Wheat	154.34	543.28	146.91	844.53	42.67
Barley	90.32	128.86	54.00	273.18	37.02
Canola	27.49	32.46	17.12	77.07	27.81
Oats	5.51	1.64	1.96	9.10	32.22
Grand Total	277.65	706.23	219.99	1203.87	39.90

...Continued

TABLE VI.6: *Con't* TRANSPORT COSTS: PAY THE PRODUCER SCENARIO

(1983-1987)

MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1985-1986					
Producer					
Wheat	81.67	248.48	77.51	407.66	25.92
Barley	84.22	70.29	24.87	189.37	26.41
Canola	30.60	41.81	22.34	94.75	31.03
Oats	4.06	1.54	1.62	7.21	25.48
Total	210.55	362.11	126.34	699.00	26.72
C.W.B.					
Wheat	-	188.22	89.95	278.17	17.68
Barley	-	53.40	36.08	89.48	12.48
Oats	3.03	0.94	1.19	5.16	18.25
Total	3.03	242.55	127.23	372.81	14.25
System					
Wheat	81.67	436.69	167.46	685.83	43.60
Barley	94.22	123.68	60.95	278.85	38.89
Canola	30.60	41.81	22.34	94.75	31.03
Oats	7.09	2.47	2.81	12.37	43.73
Grand Total	213.58	604.66	253.57	1071.81	40.97

...Continued

TABLE VI.6: ***Con't*** **TRANSPORT COSTS: PAY THE PRODUCER SCENARIO**

(1983-1987)

MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1986-1987					
Producer					
Wheat	152.35	405.41	84.43	642.19	29.00
Barley	112.09	39.90	10.95	162.94	29.65
Canola	27.64	28.89	16.89	73.41	33.88
Oats	6.28	2.12	1.56	9.95	28.71
Total	298.36	476.31	113.83	888.49	29.53
C.W.B.					
Wheat	-	236.90	80.51	317.40	14.33
Barley	-	3.34	13.05	19.39	2.98
Oats	-	1.23	1.08	2.31	6.66
Total	-	241.46	94.64	336.10	11.17
System					
Wheat	152.35	642.30	164.93	959.59	43.33
Barley	112.09	43.24	24.00	179.33	32.63
Canola	27.64	28.89	16.89	73.41	33.88
Oats	6.28	3.34	2.65	12.26	35.37
Grand Total	298.36	717.77	208.47	1224.59	40.70

...Continued

With a 20 million tonne West Coast restriction under a pay the producer method of payment the minimum cost for grain shipments to the total system would be approximately 909 million to 1.14 billion dollars. This reflects a per tonne cost of $33.74 to $42.14 over the simulated period, 1983 to 1987. Therefore, retaining the current production and marketing conditions under a method of payment change could cost the grains industry an extra $2.67/tonne to $7.22/tonne in shipping costs.

Increasing West Coast capacity to 20 million tonnes alleviates some of the additional shipment costs to specific pool accounts. These cost deductions would range between $168 and $298 million dollars, if there was a change in the existing method of payment and competitive conditions are

TABLE VI.6: ***Con't*** **TRANSPORT COSTS: PAY THE PRODUCER SCENARIO**

(1983-1987)

MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1987-1988					
Producer					
Wheat	97.30	336.77	99.33	533.40	33.92
Barley	63.98	35.69	11.80	111.47	32.54
Canola	54.94	53.25	18.32	126.50	39.83
Oats	6.56	2.29	2.14	10.98	31.68
Total	222.78	428.00	131.58	782.35	34.61
C.W.B.					
Wheat	36.90	150.71	98.66	286.25	18.20
Barley	25.68	2.08	13.98	41.74	12.18
Oats	2.74	1.20	1.67	5.62	16.20
Total	65.30	153.99	114.31	333.61	14.76
System					
Wheat	134.18	487.48	197.99	819.65	52.12
Barley	89.66	37.77	25.78	153.20	44.72
Canola	54.94	53.25	18.32	126.50	39.83
Oats	9.30	3.49	3.81	16.60	47.88
Grand Total	288.08	581.98	245.89	1115.95	49.36

maintained in reference to grain flows. On average it is estimated that the C.W.B. would subtract approximately $7.42/tonne to $11.38/tonne from pool accounts under a total costing proposal with a 20 million tonne West Coast export restriction.

TABLE VI.7: TOTAL TRANSPORT COSTS UNDER INCREASED CAPACITY (1983-1987) MILLIONS OF DOLLARS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1983-1984					
C.W.B.					
Wheat	-	196.50	60.55	257.05	15.29
Barley	-	10.80	24.96	35.76	6.13
Oats	3.48	1.31	0.73	5.51	15.18
Total	3.48	208.62	86.24	298.33	11.38
System					
Wheat	92.23	429.98	116.71	638.92	38.00
Barley	72.93	52.20	43.66	168.78	28.95
Canola	30.70	38.59	17.76	87.05	26.75
Oats	8.73	3.44	1.66	13.83	38.07
Grand Total	204.58	524.21	179.79	908.58	34.67
1984-1985					
C.W.B.					
Wheat	-	146.74	77.93	224.68	11.35
Barley	-	29.62	30.88	60.50	8.20
Oats	0.98	0.65	0.87	2.49	8.82
Total	0.98	177.00	109.68	287.66	9.53
System					
Wheat	116.09	431.20	146.91	694.20	35.07
Barley	90.32	92.22	54.00	236.54	32.06
Canola	27.49	32.46	17.12	77.07	27.81
Oats	5.51	1.64	1.96	9.10	32.22
Grand Total	239.40	557.51	219.99	1016.90	33.71

...Continued

TABLE VI.7: *Con't* TOTAL TRANSPORT COSTS UNDER INCREASED CAPACITY (1983-1987) MILLIONS OF DOLLARS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1985-1986					
C.W.B.					
Wheat	-	143.01	89.95	232.96	14.81
Barley	-	17.13	36.08	53.21	7.42
Oats	-	0.81	1.19	2.00	7.07
Total	-	160.95	127.23	288.18	11.02
System					
Wheat	81.67	391.49	167.46	640.63	40.73
Barley	94.22	87.42	60.95	242.59	33.83
Canola	30.60	41.81	22.34	94.75	31.03
Oats	4.06	2.34	2.81	9.21	32.55
Grand Total	210.55	523.06	253.57	987.17	37.73
1986-1987					
C.W.B.					
Wheat	-	156.49	80.51	236.99	10.70
Barley	-	3.34	13.05	16.39	2.98
Oats	-	1.23	1.08	2.31	6.66
Total	-	161.05	94.64	255.69	8.50
System					
Wheat	152.35	561.89	164.93	879.18	39.70
Barley	112.09	43.24	24.00	179.33	32.63
Canola	27.64	28.89	16.89	73.41	33.88
Oats	6.28	3.34	2.65	12.26	35.37
Grand Total	298.36	637.36	208.47	1144.18	38.03

...Continued

TABLE VI.8: ***Con't*** **TOTAL TRANSPORT COSTS UNDER INCREASED CAPACITY (1983-1987) MILLIONS OF DOLLARS**

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1987-1988					
C.W.B.					
Wheat	36.89	14.27	84.53	135.69	8.63
Barley	25.68	2.08	-	27.76	8.10
Oats	2.74	-	1.67	4.41	12.73
Total	65.30	16.35	86.20	167.86	7.42
System					
Wheat	134.18	351.05	183.86	669.09	42.55
Barley	89.66	37.77	14.14	141.56	41.33
Canola	54.94	53.25	18.32	126.50	39.83
Oats	9.29	2.42	3.81	15.53	44.79
Grand Total	288.08	444.48	220.12	952.68	42.14

6. Cost Savings (1983-1987)

Costs of shipping grain from each province under different "methods of payments" and constraint levels are compared to determine savings to the Canadian Wheat Board. These savings represent revenue to grain pool accounts which is associated with a method of payment change to producers. The cost scenario consisted of:

B-1: C.W.B. costs under a Pay the Producer Method of Payment compared to the present payment mechanism, together with actual production and marketing conditions representing West Coast capacity.

Table VI.7 illustrates scenario B-1 cost savings on a provincial basis over the simulation period. Given an aggregate reduction in barley production and a shift in flows from Vancouver and/or Prince Rupert ports to the East Coast, an increase in C.W.B. barley shipment costs results. Therefore, farm gate returns for prairie barley farmers decrease by approximately $1.04 to $10.00 per tonne over the simulation period. Wheat returns for producers, on the other hand, should increase between $18.84 to $34.87 per tonne, reflecting a decrease in prairie production.

TABLE VI.9: COST SAVINGS UNDER SCENARIO B-1

Millions of Dollars

PROVINCE	WHEAT	BARLEY	OATS	TOTAL
1983-1984				
Alberta	132.53	-	5.49	138.02
Per Tonne	33.76	-	24.36	16.08
Saskatchewan	268.52	(8.65)	1.83	261.70
Per Tonne	27.29	(5.14)	21.00	20.04
Manitoba	51.11	(24.96)	0.73	26.89
Per Tonne	16.78	(24.61)	14.47	5.82
Total	452.16	(33.61)	8.05	426.61
Per Tonne	26.90	(5.76)	22.17	16.25
1984-1985				
Alberta	190.88	-	6.44	197.32
Per Tonne	40.09	-	34.45	20.16
Saskatchewan	261.64	(40.79)	0.75	221.60
Per Tonne	22.77	(16.45)	19.09	14.59
Manitoba	52.07	33.14	1.09	86.30
Per Tonne	14.70	27.90	19.47	16.44
Total	504.58	(7.65)	8.28	505.22
Per Tonne	25.49	(1.04)	29.34	16.71
1985-1986				
Alberta	155.75	-	3.93	159.68
Per Tonne	51.43	-	25.78	20.45
Saskatchewan	324.70	(45.47)	1.37	280.60
Per Tonne	35.66	(18.03)	24.58	21.49
Manitoba	67.98	(26.14)	1.62	43.45
Per Tonne	18.91	(22.67)	21.56	8.09
Total	548.43	(71.61)	6.91	483.73
Per Tonne	34.87	(9.99)	24.43	18.44

...Continued

TABLE VI.9: Con't COST SAVINGS UNDER SCENARIO B-1

Millions of Dollars

PROVINCE	WHEAT	BARLEY	OATS	TOTAL
1986-1987				
Alberta	-	-	(3.15)	(3.15)
Per Tonne	-	-	(0.32)	(0.32)
Saskatchewan	364.55	(3.34)	0.75	361.96
Per Tonne	27.00	(2.61)	10.81	23.03
Manitoba	52.76	(13.05)	1.56	41.28
Per Tonne	(14.94)	(28.49)	23.90	9.32
Total	417.31	(16.39)	2.18	400.08
Per Tonne	18.84	(2.98)	6.28	13.27
1987-1988				
Alberta	-	-	12.26	12.26
Per Tonne	-	-	57.73	1.84
Saskatchewan	357.23	-	0.80	358.03
Per Tonne	37.54	-	11.57	29.90
Manitoba	78.89	(11.33)	1.85	69.42
Per Tonne	25.92	(31.34)	28.29	17.22
Total	436.12	(11.33)	14903	439.70
Per Tonne	27.73	(3.31)	42.99	19.39

B. Policy Adjustments

1. Adjusted Production (1983-1987)

The savings found in cost scenario B-1 are then inputted into each sub regional wheat and barley supply function through changes in prices to determine final production levels associated with a method of payment change to producers. It was estimated from 1983 through 1987 that if the federal Government had implemented a method of payment change and the C.W.B. could estimate cost savings associated with grain shipments and distribute them to producers, total grain production would have decreased from a low of 1.42 million tonnes (4.21 percent) to a high of 3.88 million tonnes (11.11 percent) when compared to baseline production levels reported in Table IV.1.

Changing the costing procedures to producers in reference to freight charges also creates provincial production impacts that are not similar to those found for western Canada. For example, wheat production in Alberta and Saskatchewan is estimated to increase over the simulation period, while Manitoba production would decrease (comparison of Table VI.1 to Figure VI.1), when compared to baseline production levels. The approximate magnitude of an increase in wheat production (over estimated production levels in the baseline analysis - pay the railway method of payment) within the province of Alberta would range between 362 (7.12 percent) and 605 (17.57 percent) thousand tonnes. But, during the 1986-1987 crop year, wheat production under this costing procedure would have declined by approximately 1.12 percent or 62 thousand tonnes. The direction of change in wheat production within Saskatchewan is similar to Alberta's provincial impacts. In terms of magnitude, Saskatchewan's wheat production would have increased by 4.25 to 7.99 percent or 493 to 765 thousand tonnes. Also during the 1986-1987 crop year, wheat production in Saskatchewan was estimated to decline by 2.92 percent (409 thousand tonnes). Consequently, Manitoba wheat production decreases by approximately 22 to 613 thousand tonnes. This represents a 0.68 to 16.5 percentage decline in Manitoba wheat production over the simulated period when compared to estimated wheat production levels under existing conditions.

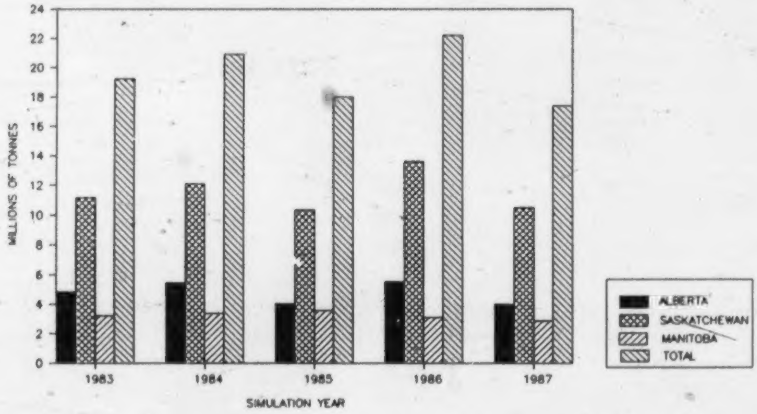


Figure VI.1: Adjusted Wheat Production - Cost Scenario B-1

It is estimated that barley production would decrease under a method of payment change in western Canada (Table VI.1 and Figure VI.2). But the magnitude of decline in barley production would vary between the three prairie provinces. In Alberta, barley production levels are estimated to decline over baseline levels by 11.11 to 23.82 percent or 587.42 to 887.49 thousand tonnes. Major declines in Saskatchewan barley production levels are expected to occur under the new costing procedure, by 0.93 to 1.24 million tonnes, representing a 30.51 to 59.58 percentage decrease. Manitoba barley production would also decrease during the simulated period, 1.79 to 2.90 million tonnes.

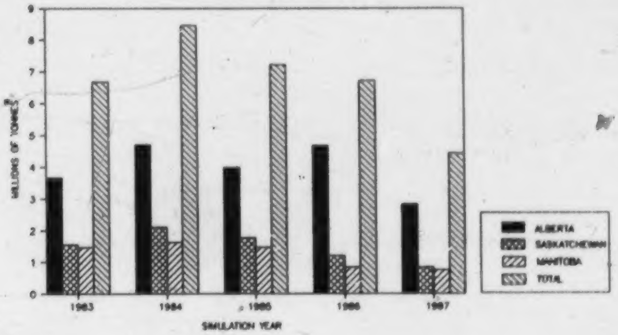


Figure VI.2: Adjusted Barley Production - Cost Scenario B-1

Canola production is estimated to increase in Manitoba and Alberta over the simulated period following a change in the method of payment with scenario B-1 cost savings (Table VI.1 and Figure VI.3). The greatest increase is in Alberta, where canola production increased between 9 to 94 thousand tonnes. Saskatchewan would experience marginal increases in canola production (during the 1983 and 1985 crop years) following a freight costing change. But Saskatchewan's canola production is estimated to decrease by 23.63 thousand tonnes during the 1984-1985 crop year, 75.81 thousand tonnes in 1986-1987, and 17.73 thousand tonnes in the 1987-1988 crop year.

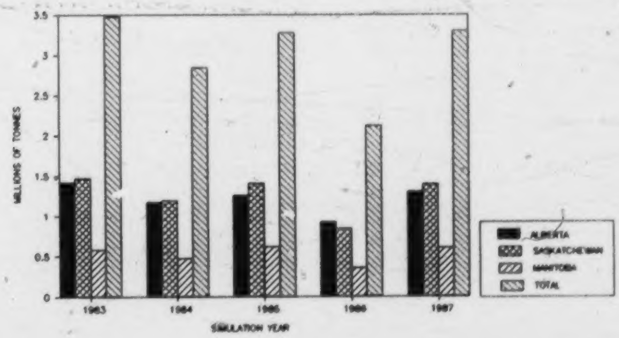


Figure VI.3: Adjusted Canola Production under Cost Scenario B-1

Production estimates under a method of payment change indicate production shifts away from the more bulky and lower value crops of barley, to the less bulky, higher value crops of wheat and canola. Since the decrease in prairie barley production is greater than the increases in wheat and canola production, prairie grain production declines over the simulated period under a method of payment change.

2. Producer Surplus (1983-1987)

The area above each sub regional supply function and below the regional equilibrium price is calculated so that an adequate measure of final producer surplus can be obtained after savings and/or dissavings are incurred in specific pool accounts (Table VI.7). After a change in the method of calculating producer transport charges, producer surplus for all grain would vary between 1.3 and 2.2 billion dollars. The result indicates a decrease in net returns to Prairie grain producers between 8.86 and 27.11 percent, if the federal Government had implemented this change in producer freight charges between 1983 and 1987. The approximate magnitude of this decline would range from a low of 210.63 to a high of 505.9 million dollars.

In Alberta, a decrease in barley returns would result from changing producer freight rates, of 24.58 to 60.89 percent or 38.89 to 96.16 million dollars. Major declines in net returns are expected to occur for Saskatchewan and Manitoba barley producers. Saskatchewan producer returns from barley production is estimated to decline over the simulation period between 21.39 (30.11 million dollars) and 78.42 (46.99 million dollars) percent. In terms of magnitude the largest decrease in Saskatchewan barley returns would amount to 106.85 million dollars. Returns of Manitoba barley producers, on the other hand, decrease by approximately 52 (38 million dollars) to 92 (22.5 million dollars) percent. Estimated magnitudes suggest that barley producers in Manitoba could experience as much as a 52 million dollar decrease in net returns.

In general, wheat returns in each province are expected to decrease after a method of payment change to producers. Nonetheless it was found that during the 1984-1985 and 1985-1986 crop years, these returns would increase after the transportation policy change for Alberta producers. This increase would amount to 24.4 million dollars during the 1984-85 crop year and 52.38 million dollars in 1985-1986. Also, in Saskatchewan wheat returns are expected to increase during the 1984-1985 and 1985-1986 crop years. This increase in Saskatchewan wheat returns is expected to be 22 and 37 million dollars. The largest impact in producer welfare from wheat production after a method of payment change occurs in Manitoba, where returns are estimated to decrease by 37 and 91 million dollars.

Canola returns for each province and for each crop year are estimated to decrease after a method of payment change. In Alberta the decrease in canola returns varies between 42 and 185 million dollars. In Saskatchewan the decrease would change downwards by approximately 32 and 45 million dollars. Marginal changes are expected to occur to Manitoba canola producers, by approximately 0.75 to 10.5 million dollars.

TABLE VI.10: ADJUSTED PRODUCER SURPLUS (1983-1987)

('000 DOLLARS)

CROP YEAR

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	113732.47	155837.91	103329.66	97853.57	24978.13
Wheat	376717.17	459755.40	412851.86	313534.47	242776.5
Canola	203465.96	162514.07	173824.67	87947.02	173307.7
SASKATCHEWAN					
Barley	110690.6	110619.4	88702.99	24181.99	12928.55
Wheat	546861.9	715021.3	645688.01	554390.57	385034.9
Canola	347168.7	266485.9	323653.0	99514.61	233293.2
MANITOBA					
Barley	24116.92	35265.28	23768.39	7376.62	2041.53
Wheat	126169.05	201113.09	266005.54	139776.40	133598.5
Canola	62075.93	59472.86	98627.11	35525.56	85959.47
PRAIRIES					
Total	1910998.8	2166085.4	2136451.1	1360100.8	1292919.6

3. Change in Consumer Surplus (1983-1987)

In western Canada after a method of payment change to producers, consumers would benefit by approximately 158 to 604 million dollars (Table VI.8). This benefit occurs because of the decreasing sub regional prices. The impacts to consumers because of a change in the method of payment are estimated to be different depending upon the crop. For instance the consumer benefit after the policy change for barley purchases ranges between 205 to 334 million dollars, whereas consumers purchasing canola could benefit by approximately 60 to 93 million dollars.

In Alberta consumers purchasing barley and/or canola would seek an increase in their welfare after a method of payment change. During the simulation period, 1983-1987, livestock producers in Alberta would experience approximately 101 to 161 million dollars. The magnitude of this increase for consumers purchasing canola within Alberta would range between 20 and 29 million dollars. Consumer surplus from wheat purchases in Alberta would decrease by 16 to 43 million dollars over the simulation period. But during the 1986-1987 crop year, consumer welfare increased by 25 million dollars from wheat purchases.

Saskatchewan barley consumers are estimated to experience an increase in welfare by approximately 53 to 97 million dollars over the simulated period after the change in the method of payment. Consumers purchasing canola within the province of Saskatchewan would see an increase in their welfare of approximately 23 to 37 million dollars. But consumers purchasing wheat in Saskatchewan between the crop years 1983-1984 to 1985-1986 would experience a decrease in their welfare, through higher prices, by approximately 6 to 10 million dollars. The remaining crop years indicate an increase in consumer welfare from Saskatchewan wheat purchases by 82 to 153 million dollars.

Manitoba consumers purchasing wheat, barley, and canola are estimated to experience an increase in welfare, except during the 1985-86 crop year, where consumer welfare decreased from wheat purchases. The gain to consumers from barley purchases, ie. livestock producers, is approximately 45 to 83 million dollars. Gains from wheat and canola purchases in Manitoba are approximately 13 to 71 million dollars, and 17 to 27 million dollars, respectively.

TABLE VI.11: CONSUMER SURPLUS CHANGE AFTER ADJUSTMENTS (1983-1987)

('000 DOLLARS)

CROP YEAR

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	113378.4	103063.5	155009.4	161221.3	101046.3
Wheat	(38174.1)	(33965.8)	(43048.7)	25097.62	(16299)
Canola	23112.8	20442.1	24996.5	21146.7	28942.7
SASKATCHEWAN					
Barley	82075.78	52797.40	96902.42	85661.40	59280.07
Wheat	(61015.6)	(90471.7)	(100633)	153122.40	8282.09
Canola	28375.38	22247.75	34451.37	23445.10	37324.47
MANITOBA					
Barley	63054.46	59346.98	82302.82	49584.78	44596.46
Wheat	13931.56	7123.94	(4550.02)	59602.99	38344.98
Canola	19580.05	17432.59	26902.61	24811.45	26264.50
PRAIRIES					
Total	244318.83	158016.66	27233.24	603693.74	327783.1

In western Canada net welfare changes because of a different method of payment following price adjustments under Scenario B-1 are at a low of -351.74 to a high of 112.56 million dollars. Distribution of welfare differs between wheat, barley, and canola on a aggregate basis. For instance the net welfare gain in the prairie barley economy is estimated to range between 53 and 138 million dollars. The canola economy would experience a welfare gain ranging from 10.5 to 23.6 million dollars over the simulated period, following a method of payment change. It is estimated that if the federal Government had implemented a method of payment change in western Canada, the wheat economy would have experienced a net loss in welfare, of approximately 7 to 122 million dollars.

Intraprovincial impacts on net welfare are diverse given changes in producer freight rate costing. In Alberta the barley economy was found to gain approximately 52 to 86 million dollars, that is, the loss in producer surplus is less than the gain in consumer surplus over the simulated period. Also, the canola economy in Alberta would experience a gain of approximately 5 to 11.8 million dollars during the same time frame. The wheat economy within the province of Alberta is estimated to experience a decrease in net welfare, 20 to 147 million dollars. However during the 1985-1986 crop year the wheat economy in Alberta would have an increase in net welfare of approximately 9 million dollars.

The Saskatchewan barley economy because of changes in the method of payment would experience gains of approximately 12.3 to 51.96 million dollars and losses of 10 to 20 million dollars. The canola economy in Saskatchewan is estimated to have net welfare losses during each crop year in the simulated model, approximately 3 to 14.6 million dollars. In the Saskatchewan wheat economy net welfare gains would have been experienced during the 1986 and 1987 crop years, by 15.3 and 3.95 million dollars. But during the 1983 to 1985 crop years there would have been a net loss to Saskatchewan's wheat economy, 68.19 to 276.03 million dollars.

In Manitoba over the simulated period, it is estimated that the barley and canola economy would have experienced a net welfare gain. This gain in barley ranges from 17 to 31 million dollars and 9 to 20 million dollars in the canola economy. The wheat economy is estimated to experience net welfare losses in Manitoba, approximately 9 to 77 million dollars, after a method of payment change.

4. Grain Flows (1983-1987)

In Figure VI.4 optimal transport patterns of wheat in western Canada following a method of payment change to producers with B-1 cost savings are presented. Over the simulated period, it was estimated that 3.4 to 8.8 million tonnes of wheat would be transported through Vancouver and/or Prince Rupert. On the other hand, it would be more cost efficient if approximately 4.3 to 17.6 million tonnes were allocated to East Coast ports. Export restrictions at the West Coast became binding during the 1984 and 1985 crop years. This constraint caused 2.1 million tonnes in 1984 and 605 thousand tonnes in 1985 of wheat, from Alberta, to be shipped through Thunder Bay. The West Coast tended to be the more lucrative position for wheat shipments from the provinces of Saskatchewan and Manitoba over the simulated period. An exception occurred during the 1986 and 1987 crop years in Saskatchewan, when 6.9 and 10.4 million tonnes respectively were transported through the eastern transport system in western Canada.

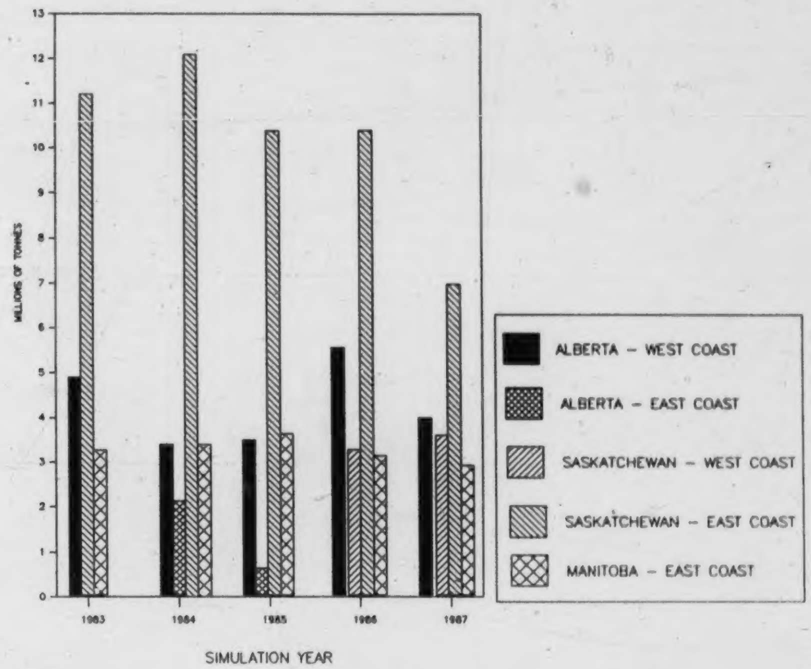


Figure VI.4: Wheat Transport Patterns under Cost Scenario B-1

During the simulated period (1983-1987) the majority of barley exports in western Canada were shipped via Prince Rupert and/or Vancouver, 2.6 to 5.3 million tonnes. But 1.4 million tonnes of barley during the 1983 crop year and 2.8 million tonnes during the 1984 crop year were exported through Thunder Bay. Barley shipments through the East Coast during the 1983 and 1984 crop years were exported from both Saskatchewan (645 thousand tonnes and 1.9 million tonnes respectively) and Manitoba (706 thousand tonnes and 937 thousand tonnes respectively). Figure VI.5 illustrates the optimal shipping patterns for barley in western Canada following price adjustments because of a different method of payment with actual production and marketing restrictions at the West Coast.

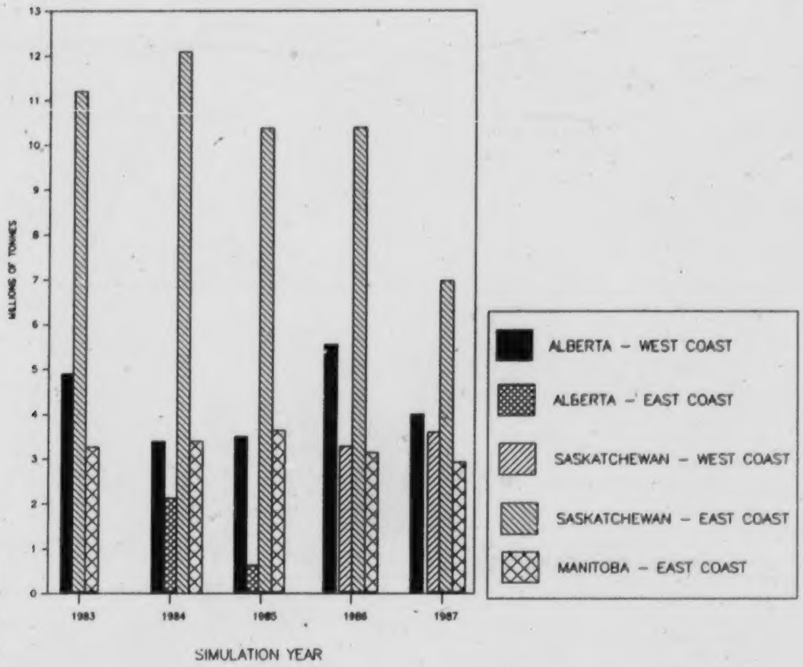


Figure VI.5: Barley Transport Patterns under Cost Scenario B-1

5. Freight Costs (1983-1987)

Table VI.12 illustrates the approximate magnitude of transport costs given the optimal grain flows in section 4. It was found that if the federal Government had implemented the method of payment change to producers during the simulated period, producer transport costs from all grain shipments would have increased to 679.28 and 879.85 million dollars. This represents a $12.01 to $22.32 per tonne increase in wheat shipping costs and a $15.76 to $24.37 per tonne increase in barley freight costs. The C.W.B., annually would pay 253.03 to 543.29 million dollars under a producer method of payment on all grain shipments. The Board would have also experienced a decrease in wheat shipping costs over the simulation period by $1.42 to $5.18 per tonne when compared to Thunder Bay/Vancouver pricing with a method of payment to the railway. During the 1984 crop year, with a 10 million tonne constraint at West Coast ports, a increase in wheat freight costs to the C.W.B. results, by approximately $2.17 per tonne. Barley shipping costs to the C.W.B. would increase during each year of the simulation model, by $0.16 to $6.69 per tonne. Under a method of payment to producers, the C.W.B. is estimated to incur costs on Saskatchewan wheat shipments of approximately 174 to 345 million dollars, from 1983 to 1987. Also the C.W.B would incur costs on Manitoba barley shipments of 61.62 to 89.77 million dollars.[26]

TABLE VI.12: ADJUSTED TRANSPORT COSTS WITH B-1 SAVINGS

(1983-1987) MILLIONS OF DOLLARS

PAY THE PRODUCER WITH CURRENT WEST COAST CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1983-1984					
Producer					
Wheat	129.66	323.24	57.16	510.06	22.95
Barley	86.59	43.89	3.37	133.86	24.21
Canola	34.85	39.14	17.53	91.53	26.31
Oats	6.73	2.14	0.94	9.81	27.00
Total	257.83	408.42	79.00	745.25	23.63
C.W.B.					
Wheat	-	206.05	61.62	267.67	12.05
Barley	-	17.67	0.57	18.24	3.30
Oats	3.24	1.30	0.73	5.26	14.49
Total	3.24	225.02	62.92	291.18	9.23
1984-1985					
Producer					
Wheat	144.25	225.98	65.84	436.07	20.85
Barley	88.67	49.34	18.26	156.27	24.14
Canola	20.54	32.83	17.57	78.93	27.77
Oats	5.91	1.01	1.09	8.01	28.36
Total	267.37	309.15	102.75	679.28	22.30
C.W.B.					
Wheat	46.07	345.11	74.39	465.57	22.26
Barley	-	48.96	24.38	73.34	11.33
Oats	2.89	0.63	0.87	4.38	15.51
Total	48.96	394.69	99.64	543.29	17.84

...Continued

---

[26] Adjusted freight costs to the C.W.B. on a sub regional basis are in Appendix C, Table C-1.

TABLE VII.9: *con't* ADJUSTED TRANSPORT COSTS WITH B-1 SAVINGS
(1983-1987) MILLIONS OF DOLLARS

PAY THE PRODUCER WITH CURRENT WEST COAST CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1985-1986					
Producer					
Wheat	95.25	283.98	77.35	456.58	25.38
Barley	78.44	48.93	22.27	149.64	28.34
Canola	34.00	42.71	25.02	101.73	31.06
Oats	5.23	1.54	1.62	8.39	29.64
Total	212.93	377.15	126.25	716.33	26.78
C.W.B.					
Wheat	37.11	259.02	89.77	385.89	21.45
Barley	-	-	8.62	8.62	1.63
Oats	2.43	0.93	1.19	4.56	16.11
Total	39.54	259.95	99.58	399.07	14.92
1986-1987					
Producer					
Wheat	164.18	410.43	74.09	648.69	29.19
Barley	109.67	33.49	4.25	147.41	30.64
Canola	27.67	28.41	15.84	71.92	33.73
Oats	8.14	2.13	1.56	11.83	34.13
Total	309.66	474.45	95.74	879.85	29.88
C.W.B.					
Wheat	-	236.21	70.64	306.86	13.81
Barley	-	-	1.65	1.65	0.34
Oats	3.51	1.22	1.08	5.81	16.76
Total	3.51	237.43	73.37	314.31	10.67
1987-1988					
Producer					
Wheat	116.97	315.26	67.49	499.71	28.78
Barley	54.10	22.09	1.05	77.24	30.17
Canola	38.50	45.93	26.70	111.12	33.65
Oats	8.01	2.09	1.53	11.64	33.57
Total	217.57	385.38	96.76	699.71	29.77
C.W.B.					
Wheat	-	174.00	72.24	246.25	14.18
Barley	-	-	0.40	0.40	0.16
Oats	3.86	1.33	1.19	6.38	18.40
Total	3.86	175.34	73.83	253.03	10.77

VII. C.W.B. PROPOSAL UNDER PAY THE PRODUCER ALTERNATIVE

A. Initial Results before Adjustments

1. Production Responses (1983-1987)

If the C.W.B. implemented its new pricing proposal under a method of payment change to producers, total crop production would vary between 23.4 to 30.9 million tonnes over the simulated period (Table VII.1). This represents a decrease of approximately 2.7 to 4 million tonnes or 8 to 14 percent from baseline production levels under the pay the railway method of payment. In comparison to initial production levels under pay the producer method of payment in Table VI.1, introduction of the C.W.B. proposal could cause a further 1 to 2 million tonne reduction in Saskatchewan and Manitoba crop production. No change would be experienced to Alberta producers because of this provinces' proximity to West Coast ports.

Saskatchewan wheat production under this scenario is estimated to decrease by 371 to 720 thousand tonnes or 3.21 to 5.14 percent when compared to baseline levels in Table VI.1. Barley production would also decrease given a method of payment change with the new C.W.B. proposal in effect. This decrease is estimated to range between 438 to 687 thousand tonnes or 14 to 28 percent for Saskatchewan barley producers. In relation to production changes in wheat and barley, the estimated decrease in canola production would be marginal.

This decrease in wheat production represents an additional decline of 100 to 145 thousand tonnes over those levels found under a method of payment change in Table VI.1. Barley production within the province of Saskatchewan would decrease a further 124 to 130 thousand tonnes when the C.W.B. proposal is introduced compared to production under a pay the producer scenario.

In Manitoba wheat production would decline between 516 and 696 thousand tonnes or 16 to 96 percent from 1983 to 1987. This decrease represents a reduction of a further 285 to 394 thousand tonnes when compared to Table VI.1. Also wheat production would decline between 516 and 696 thousand tonnes during the simulated period over simulated production levels under pay the railway method of payment. Canola production in Manitoba would also decrease by approximately 12.6 to 43.8 thousand tonnes when compared to the existing transportation policy under Thunder Bay/Vancouver pricing.

TABLE VII.1: SIMULATED CROP PRODUCTION (1983-1987)

('000 TONNES)

CROP YEAR

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	4032.56	4758.18	4557.96	4737.39	3048.28
Wheat	3926.05	4760.95	3028.49	5110.92	3166.11
Canola	1297.87	1127.61	1130.89	922.87	1220.52
SASKATCHEWAN					
Barley	2121.48	2603.77	2673.72	1717.29	1403.53
Wheat	9630.13	11221.49	8921.17	13298.34	9321.36
Canola	1454.12	1212.78	1378.85	868.24	1398.24
MANITOBA					
Barley	1537.73	1653.62	1604.08	890.91	797.22
Wheat	2734.51	3116.54	3139.61	3016.62	2514.34
Canola	497.04	461.29	543.32	370.45	557.37
PRAIRIES					
Total	27231.49	30916.23	26978.09	30933.03	23426.96

2. Producer Surplus (1983-1987)

The introduction of the new pricing arrangement by the C.W.B. under a pay the producer method of payment also changes producer welfare to grain producers in western Canada. Overall producer welfare would vary between 1.04 and 2.18 billion dollars with a producer method of payment under the new C.W.B. proposal. Associated with the previous discussed decrease in production (comparison of production after implementation of the C.W.B. proposal under a method of payment to producers to the baseline estimated levels) is a reduction in producer welfare. This decrease in producer welfare for all crops would range between 9.66 and 72.6 million dollars over the simulated period. In percentage terms this reduction in welfare to producers is approximately 0.52 to 2.9 percent over baseline levels (pay the railway method of payment).

In Saskatchewan producer welfare would decrease for wheat producers over the simulation period by 82 to 251 million dollars or 2 to 3 percent, when compared to baseline levels in Table VI.1. It was estimated that producer welfare to barley farmers located in Saskatchewan would also decrease, by approximately 45 to 93 million dollars from 1983 to 1987, if the C.W.B. had implemented their pricing proposal under a method of payment change to producers. This represents a 34 to 75 percent decrease in net returns from barley production in the province of Saskatchewan. Producer welfare associated with canola production in Saskatchewan over baseline estimated levels would decrease by 30 to 44 million dollars or 9 to 16 percent over the simulated period.

Producer welfare for Manitoba wheat producers would decrease by approximately 53 to 113 million dollars or 24 to 50 percent during the simulated period when compared to welfare measures under pay the railway method of payment. Major decreases in producer welfare within the province of Manitoba are expected to have occurred, if the federal government had implemented a method of payment change within western Canada and the C.W.B. had introduced their new pricing arrangement from 1983 to 1987. The approximate magnitude of this decrease is, 22 to 43 million dollars, which represents a 51 to 88 percent decrease in barley returns. Manitoba's net returns from canola production following a grain price policy change with a different method of payment would result in a 6 to 14 million dollar decrease, which represents a decrease equivalent to 2 to 15 percent.

TABLE VI.2: SIMULATED PRODUCER SURPLUS, (1983-1987)

('000 DOLLARS)

CROP YEAR

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	78201.65	153007.45	132914.68	100468.29	28613.63
Wheat	493325.71	355315.97	271375.72	256399.90	155055.1
Canola	203465.96	162514.07	173824.67	87947.02	173307.7
SASKATCHEWAN					
Barley	47813.49	121211.55	111369.64	32449.75	15173.62
Wheat	741170.22	587826.52	451978.67	483931.09	259224.7
Canola	347168.73	266485.99	323653.03	99514.61	232293.2
MANITOBA					
Barley	18717.03	36289.83	32467.06	8769.92	2894.79
Wheat	191004.19	164631.49	190537.20	122037.32	89748.08
Canola	62075.95	59472.86	98627.11	35525.56	85959.5
PRAIRIES					
Total	2182943	1906756	1786748	1227034	1042270

3. Changes in Consumer Surplus (1982-1987)

Table VII.3 illustrates changes in consumer surplus on a provincial basis. These changes are measured between Thunder Bay/Vancouver pricing under pay the railway method of payment and St. Lawrence/Vancouver pricing with producers paying the full W.G.T.A. freight rate. The impact to Alberta consumers remains equivalent to those levels indicated in Table VI.1 because prices are equivalent in both scenarios. Alberta producers would continue to deduct the West Coast rate to determine a farm gate return. The total change in consumer surplus for all crops and regions includes these changes to Alberta consumers.

In total, consumers in western Canada could gain approximately 699 million to 1.1 billion dollars if there was a change in the method of payment along with using the St. Lawrence as a price basing point instead of Thunder Bay over the simulation period. Consumers of Saskatchewan wheat would gain between 223 to 445 million dollars, as opposed to a 59 to 94 million dollar gain from barley purchases. Consumer surplus for canola within the province of Saskatchewan increases by 228 to 375 million dollars because of the proposed pricing policy changes over the simulation period. In Manitoba, consumer surplus would also increase for all three crops. The approximate magnitudes of this increase would be 42 to 67 million dollars for barley consumers, 95 to 156 million dollars from wheat purchases, and 18 to 26 million dollars in canola consumer surplus.

TABLE VII.3: CHANGES IN CONSUMER SURPLUS, (1983-1987)

('000 DOLLARS)

CROP YEAR

CROP	83/84	84/85	85/86	86/87	87/88
SASKATCHEWAN					
Barley	58968.41	59074.16	89944.34	94027.07	68746.90
Wheat	269924.61	223149.70	269474.71	444763.69	334609.3
Canola	28708.85	22771.81	33910.26	24496.39	37527.7
MANITOBA					
Barley	54422.15	57634.55	66954.94	46990.10	42031.95
Wheat	95051.73	127311.11	146883.44	155978.13	133525.6
Canola	18406.37	17558.51	25857.43	25945.43	25707.43
PRAIRIES					
Total	707615.70	699475.28	830518.23	1071807.9	841689.8

Net welfare given the change in a method of payment and price basing point are determined by summing the change in producer and consumer surplus. This measure indicates if the policy changes proposed creates a negative or positive impact to the grains economy within western Canada.

From the changes in consumer and producer surplus it was estimated that a net welfare gain would occur for western Canada after implementation of the proposed grain pricing policies, of approximately 213 to 474 million dollars over the simulation period. But the magnitude of regional welfare impact between wheat, barley, and canola needs to be discussed. For the barley economy a welfare gain of approximately 61 to 120 million was found in western Canada. Consequently, during the 1983-1984 crop year a net welfare loss was estimated in western Canada after implementation of the method of payment change and the C.W.B. proposal. This estimated loss amounted to 23 million dollars. Estimates from the production simulation sub model indicate welfare gains for both wheat and canola. The magnitude of this welfare gain for wheat was 119 to 486 million dollars, and 10 to 23 million dollars for the canola economy. In general these changes in both the method of payment to producers and the C.W.B. pricing proposal creates a transfer of wealth from producers to consumers. In the case of barley this indicates positive impacts for the livestock sector within western Canada, that is, cheaper barley feed costs.

The Saskatchewan wheat economy would gain in terms of net welfare following these policy changes, approximately 112 to 296 million dollars from 1983 to 1987. In barley, a net welfare gain was estimated to occur between 1985 to 1987 by approximately 24 to 58 million dollars. During 1983 and 1984 a net regional welfare loss was estimated, approximately 3.2 to 37 million dollars. This implies that the producer surplus decrease was greater than the consumer surplus gain, therefore creating a loss to society. The canola sector in Saskatchewan was estimated to experience a loss during each crop year of the simulation model. This again suggests a net loss to society by approximately the difference between the changes in producer and consumer surplus.

In Manitoba, estimates suggest net welfare gains for wheat, barley, and canola during the simulation period. For the barley economy this transfer of wealth from producers to consumers amounts to approximately 16 to 24 million dollars, thus creating a gain to society. On the other hand, the gain in the Manitoba wheat sector is approximately 34 to 83 million dollars over the simulation period. During the same time period gains to the canola sector in Manitoba are estimated to be 8 to 20 million dollars.

4. Optimal Grain Shipment Patterns (1983-1987)

Table VII.4 illustrates optimal grain transportation patterns under a method of payment change to producers with St. Lawrence/Vancouver pricing and actual production and marketing conditions representing West Coast capacity. If competitive conditions are to be maintained in the western Canadian grains economy under St. Lawrence/Vancouver pricing then there would be approximately a 50:50 split in transport patterns between the West and East coast ports. Comparing grain transportation patterns under a method of payment change with Thunder Bay/Vancouver pricing to St. Lawrence/Vancouver pricing suggests a shift in grain flows from the provinces of Saskatchewan and Manitoba. The shift would allow an additional 2 to 15 percent of grain exports from these provinces to be allocated to the West Coast when compared to Thunder Bay/Vancouver pricing under a method of payment change. This is due mainly to less grain being exported under St. Lawrence/Vancouver pricing.

TABLE VII.4: GRAIN FLOWS : ST. LAWRENCE PRICING

Millions of Tonnes (1982-1987)

PAY THE PRODUCER

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
11.7 MILLION TONNE WEST COAST CONSTRAINT (1983-1984).						
WEST COAST						
ALBERTA	3.93	3.13	1.30	0.05	8.41	97.90
SASK.	-	1.34	1.45	-	2.79	21.85
MANITOBA	-	-	0.50	-	0.50	12.32
TOTAL	3.93	4.47	3.25	0.05	11.70	46.03
EAST COAST						
ALBERTA	-	-	-	0.18	0.18	2.10
SASK.	9.63	0.26	-	0.09	9.98	78.15
MANITOBA	2.73	0.78	-	0.05	3.56	87.68
TOTAL	12.36	1.04	-	0.32	13.72	53.97
10 MILLION TONNE WEST COAST CONSTRAINT (1984-1985).						
WEST COAST						
ALBERTA	3.31	3.71	1.13	0.15	8.30	84.78
SASK.	-	-	1.21	-	1.21	8.09
MANITOBA	-	-	0.49	-	0.49	9.53
TOTAL	3.31	3.71	2.83	0.15	10.00	50.15
EAST COAST						
ALBERTA	1.45	-	-	0.04	1.49	15.22
SASK.	11.22	2.48	-	0.04	13.74	91.91
MANITOBA	3.40	1.19	-	0.06	4.65	90.47
TOTAL	16.07	3.67	-	0.14	19.88	49.85
12 MILLION TONNE WEST COAST CONSTRAINT (1985-1986).						
WEST COAST						
ALBERTA	3.03	3.50	1.13	0.02	7.68	98.34
SASK.	1.59	-	1.38	-	2.97	23.24
MANITOBA	-	-	0.54	-	0.54	11.64
TOTAL	4.62	3.50	3.05	0.02	11.19	44.35
EAST COAST						
ALBERTA	-	-	-	0.13	0.13	1.66
SASK.	7.33	2.42	-	0.06	9.81	76.76
MANITOBA	3.14	0.89	-	0.07	4.10	88.36
TOTAL	10.47	3.31	-	0.26	14.04	55.65

...Continued

TABLE VII.3: con't GRAIN FLOWS: ST. LAWRENCE PRICING

Millions of Tonnes (1982-1987)

REGION	WHEAT	BARLEY	CAN.	OATS	TOTAL	%
15.7 MILLION TONNE WEST COAST CONSTRAINT (1986-1987).						
WEST COAST						
ALBERTA	5.11	3.76	0.92	0.21	10.00	100.0
SASK.	3.26	1.20	0.87	-	5.33	34.52
MANITOBA	-	-	0.37	-	0.37	10.19
TOTAL	8.37	4.96	2.16	0.21	15.70	54.00
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASK.	10.04	-	-	0.07	10.11	65.48
MANITOBA	3.02	0.17	-	0.07	3.26	89.81
TOTAL	13.06	0.17	-	0.14	13.37	46.00
13.4 MILLION TONNE WEST COAST CONSTRAINT (1987-1988).						
WEST COAST						
ALBERTA	3.17	2.07	1.22	0.21	6.67	100.0
SASK.	3.83	0.94	1.40	-	6.17	52.60
MANITOBA	-	-	0.56	-	0.56	-
TOTAL	7.00	3.01	3.18	0.21	13.40	61.98
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASK.	5.49	-	-	0.07	5.56	47.40
MANITOBA	2.51	0.08	-	0.07	2.66	100.0
TOTAL	8.00	0.08	-	0.14	8.22	38.02

5. Shipping Costs (1983-1987)

If the C.W.B. proposal was put into effect along with a change in the method of paying grain transport rates under existing market conditions, the result would be a decline in total logistic costs from grain shipments when compared to Thunder Bay/Vancouver pricing under the current transportation policy (Tables VI.6 and VII.5). This reduction in total logistic costs is due to a decrease in total crop production with marginal shifts in transportation patterns. The approximate magnitude of this decline ranges from 225 to 307 million dollars. In comparison to the baseline results under a method of payment change to producers, total system costs over the simulation period would have decreased by 79 to 308 million dollars.

The C.W.B. under its new proposal and a method of payment change to producers would experience shipment costs for all grains in the range of 112 to 255 million dollars over the simulated period. This represents a 35 to 63 percent decrease in C.W.B. grain shipping costs. This indicates benefits to grain pool accounts. In comparison to Thunder Bay/Vancouver pricing under a method of payment change, shipping costs to the C.W.B. would decrease by approximately 24 to 66 percent.

Producer freight costs from shipping grain are estimated to range from 28 to 32 dollars per tonne over the simulation period under St. Lawrence/Vancouver pricing and a method of payment to producers. This represents a significant increase in producer freight costs. Under Thunder Bay/Vancouver pricing and a method of payment to the railway, producers paid approximately 5 to 7 dollars per tonne to transport grain. But the C.W.B. gains in pool accounts may outweigh these producers' costs, therefore leaving the producer better off after a change in the method of payment and price basing point (St. Lawrence).

TABLE VII.5: TRANSPORT COSTS WITH ST. LAWRENCE PRICING

(1983-1987) MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1983-1984					
Producer					
Wheat	92.23	270.07	95.95	458.24	28.13
Barley	72.93	43.22	27.52	143.66	26.01
Canola	30.70	38.71	17.44	86.85	26.73
Oats	5.25	2.36	1.66	9.28	25.54
Total	201.11	354.35	142.58	698.03	27.51
C.W.B.					
Wheat	-	108.25	8.83	117.09	7.19
Barley	-	3.75	6.24	9.99	1.81
Oats	-	0.97	-	4.27	11.74
Total	-	112.97	15.08	131.34	5.18
System					
Wheat	92.23	378.32	104.79	575.33	35.32
Barley	72.93	46.97	33.76	153.65	27.82
Canola	30.70	38.71	17.44	86.85	26.73
Oats	8.55	3.33	1.66	13.54	37.28
Grand Total	204.41	467.32	157.65	829.38	32.68

...Continued

TABLE VII.5: ***Con't*** **TRANSPORT COSTS WITH ST. LAWRENCE PRICING**

(1983-1987) MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1984-1985					
Producer					
Wheat	116.09	323.04	125.38	564.51	29.12
Barley	90.32	69.46	43.77	203.54	27.59
Canola	27.49	33.35	17.93	78.77	27.86
Oats	4.53	1.10	1.96	7.58	26.85
Total	238.42	426.96	189.03	854.40	28.66
C.W.B.					
Wheat	9.23	154.64	15.72	179.59	9.26
Barley	-	54.83	10.24	65.07	8.82
Oats	0.98	0.50	-	1.48	5.22
Total	10.21	209.97	25.96	246.13	8.25
System					
Wheat	125.32	477.68	141.10	744.10	38.39
Barley	90.32	124.29	54.00	268.61	36.41
Canola	27.49	33.35	17.93	78.77	27.86
Oats	5.51	1.60	1.96	9.06	32.08
Grand Total	248.63	636.92	214.98	1100.54	36.91

...Continued

TABLE VII.5: ***Con't*** **TRANSPORT COSTS WITH ST. LAWRENCE PRICING**

(1983-1987) MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1985-1986					
Producer					
Wheat	81.67	285.41	128.13	495.21	32.82
Barley	94.22	75.24	36.42	205.87	30.24
Canola	30.60	41.94	22.17	94.71	31.02
Oats	4.06	1.75	2.81	8.62	30.45
Total	210.55	404.33	189.53	804.41	31.97
C.W.B.					
Wheat	-	89.67	18.12	107.79	7.14
Barley	-	61.63	10.74	72.36	10.63
Oats	2.87	0.63	-	3.49	12.34
Total	2.87	151.92	28.85	183.64	7.30
System					
Wheat	81.67	375.08	146.24	603.00	39.96
Barley	94.22	136.86	47.15	278.23	40.87
Canola	30.60	41.94	22.17	94.71	31.02
Oats	6.93	2.37	2.81	12.11	42.80
Grand Total	213.42	556.26	218.38	988.05	39.27

...Continued

TABLE VII.5: ***Con't*** **TRANSPORT COSTS WITH ST. LAWRENCE PRICING (1983-1987) MILLIONS OF DOLLARS**

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1986-1987					
Producer					
Wheat	152.35	311.38	135.87	599.60	27.98
Barley	112.09	40.31	7.72	160.12	31.23
Canola	27.64	28.98	16.69	73.30	33.86
Oats	6.28	1.01	2.65	9.93	28.64
Total	298.36	381.68	162.92	842.96	29.07
C.W.B.					
Wheat	-	247.39	4.98	252.37	11.78
Barley	-	-	1.26	1.26	0.25
Oats	-	2.19	-	2.19	6.30
Total	-	249.58	249.58	255.82	8.82
System					
Wheat	152.35	558.77	140.85	851.97	39.76
Barley	112.09	40.31	8.98	161.38	31.47
Canola	27.64	28.98	16.69	73.30	33.86
Oats	6.28	3.19	2.65	12.12	34.95
Grand Total	298.36	631.26	169.15	1098.78	37.89

...Continued

TABLE VII.5: *Con't* TRANSPORT COSTS WITH ST. LAWRENCE PRICING

(1983-1987) MILLIONS OF DOLLARS

ACTUAL PRODUCTION AND MARKETING CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1987-1988					
Producer					
Wheat	92.68	279.09	111.49	483.26	32.21
Barley	60.56	31.13	3.44	95.13	30.77
Canola	36.14	45.95	24.71	106.81	33.63
Oats	6.18	0.99	2.90	10.07	29.05
Total	195.56	357.16	142.54	695.26	32.26
C.W.B.					
Wheat	-	85.61	22.68	108.29	7.22
Barley	-	-	1.19	1.19	0.38
Oats	-	2.64	0.14	2.78	8.02
Total	-	88.25	24.00	112.26	5.21
System					
Wheat	92.68	364.70	134.17	591.55	39.43
Barley	60.56	31.13	4.63	96.32	31.16
Canola	36.14	45.95	24.71	106.81	33.63
Oats	6.18	3.63	3.04	12.85	37.06
Grand Total	195.56	445.41	166.55	807.52	37.47

6. Cost Savings (1983-1987)

Cost savings to the C.W.B. are also determined under the C.W.B. proposal with producers paying full W.G.T.A. freight costs. These cost savings are calculated by using the following comparison.

B-2: Comparing Board shipping costs under Thunder Bay/Vancouver pricing to St. Lawrence/Vancouver pricing, with pay the producer method of payment while actual marketing and production conditions represent West Coast capacity.

Table VII.6 illustrates provincial cost savings to the C.W.B. on a crop basis. This cost comparison analyses the benefits that could be obtained by introducing the new C.W.B. proposal under a method of payment to producers.

The results under cost scenario B-2 indicate a cost savings to the C.W.B. from all grain shipments between $5.80 to $8.29 per tonne. In terms of Board savings on specific crops, wheat is estimated at $7.68 to $11.29 per tonne, with an associated savings in barley ranging from $2.95 to $4.34 per tonne.

Given provincial shipment patterns in Tables VI.4 and VII.3 the C.W.B would occur cost savings from grain shipments. Consequently, during the 1985-1986 crop year the Board would occur increases in barley shipment costs from the province of Saskatchewan. This is due to a shift in barley shipment patterns from West Coast to East coast ports, of 814 thousand tonnes.

TABLE VII.6: COST SAVINGS UNDER SCENARIO B-2

Millions of Dollars

PROVINCE	WHEAT	BARLEY	OATS	TOTAL
1983-1984				
Alberta	-	-	0.17	0.17
Per Tonne	-	-	0.77	0.02
Saskatchewan	88.25	7.05	0.35	95.65
Per Tonne	9.16	4.39	3.98	7.49
Manitoba	51.72	18.72	0.73	71.16
Per Tonne	18.91	23.86	14.35	17.50
Total	139.97	25.77	1.25	166.98
Per Tonne	8.59	4.66	3.44	6.57
1984-1985				
Alberta	29.02	-	-	29.02
Per Tonne	6.10	-	-	2.97
Saskatchewan	104.18	11.42	0.15	115.76
Per Tonne	9.28	4.61	3.85	7.74
Manitoba	62.22	20.64	0.87	83.72
Per Tonne	18.29	17.38	15.44	16.31
Total	195.42	32.07	1.02	228.50
Per Tonne	10.08	4.34	3.60	7.65
1985-1986				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	98.55	(8.23)	0.31	90.62
Per Tonne	11.05	(3.40)	5.58	7.09
Manitoba	71.84	25.35	1.19	98.38
Per Tonne	22.88	28.40	15.95	21.16
Total	170.38	17.11	1.67	189.17
Per Tonne	11.29	2.51	5.90	7.50

...Continued

TABLE VII.6: Con't COST SAVINGS UNDER SCENARIO B-2

Millions of Dollars

PROVINCE	WHEAT	BARLEY	OATS	TOTAL
1986-1987				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	149.96	3.34	(0.96)	152.34
Per Tonne	16.96	2.79	(13.95)	9.87
Manitoba	75.53	11.79	1.08	88.40
Per Tonne	25.04	68.83	16.55	24.39
Total	225.49	15.13	0.12	240.74
Per Tonne	10.52	2.95	0.35	8.29
1987-1988				
Alberta	-	-	-	-
Per Tonne	-	-	-	-
Saskatchewan	61.56	-	(1.07)	60.49
Per Tonne	6.60	-	(15.54)	5.16
Manitoba	53.61	10.14	1.05	64.80
Per Tonne	21.32	130.61	16.05	20.16
Total	115.17	10.14	(0.02)	125.29
Per Tonne	7.68	3.28	(0.06)	5.80

B. Policy Adjustments

1. Adjusted Production (1983-1987)

Given the cost savings determined in scenario B-2, adjusted production is derived from the sub regional supply functions. Figure VII.1 illustrates adjusted wheat production on a provincial basis over the simulation period. It was found that wheat output in western Canada would have varied between 15.46 and 22.17 million tonnes, if the C.W.B. proposal had been implemented under a method of payment change to producers. This represents approximately a 4.89 (1.14 million tonnes) to 7.76 (1.3 million tonnes) percent decline in wheat production when compared to production levels in the baseline analysis (Thunder Bay/Vancouver pricing under a method of payment to railways). The largest impact, in comparison to baseline production levels, would occur in Manitoba, where wheat production is estimated to decrease by 492.03 (15.04 percent) to 624.26 (19.51 percent) thousand tonnes. Saskatchewan wheat production would also decrease over the simulation period. The approximate magnitude of this decrease ranges from 242.14 (2.53 percent) to 367.33 (2.62 percent) thousand tonnes. Alberta wheat production when compared to baseline results decreases by 98.37 (2.86 percent) to 573.39 (9.61 percent) thousand tonnes from 1983 to 1987.

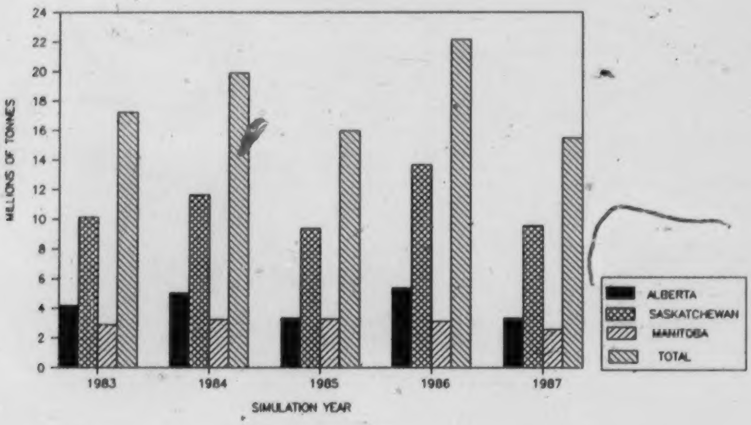


Figure VII.1: Adjusted Wheat Production under Cost Scenario B-2

Adjusted barley production under cost scenario B-2 is presented in Figure VII.2 on a provincial basis. Barley production in western Canada under the new C.W.B. proposal with a method of payment change to producers is estimated to vary between 5.37 to 9.19 million tonnes. In comparison to Table IV.1 (baseline) barley production is estimated to decrease between 1.71 (15.67 percent) to 1.82 (25.31 percent) thousand tonnes over the simulation period. Major regional impacts are estimated to occur in barley production when compared to estimated baseline levels (Table IV.1). In Alberta, barley production would decrease by approximately 591.35 (15.87 percent) thousand tonnes to 1.07 (18.03 percent) million tonnes, given a method of payment change to producers under St. Lawrence/Vancouver pricing. The decrease in Saskatchewan barley production is estimated to decrease by 665.17 (20.28 percent) to 681.33 (32.79 percent) thousand tonnes. Manitoba barley production is estimated to decrease by 428.25 (20 percent) to 540.86 (39 percent) thousand tonnes from 1983 to 1987.

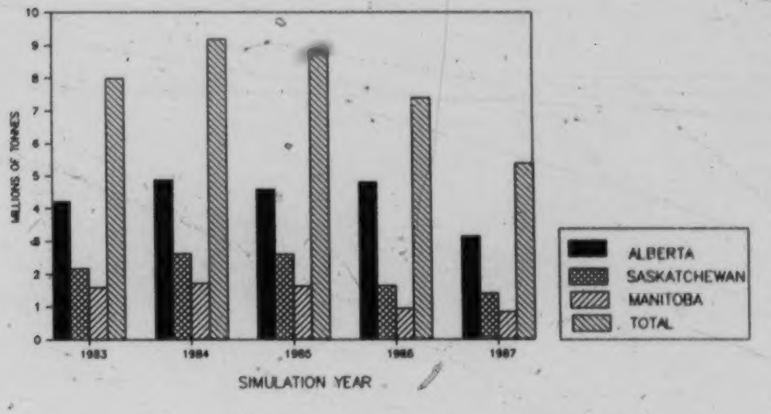


Figure VII.2: Adjusted Barley Production under Cost Scenario B-2

On a provincial basis, canola production in western Canada would vary between 2.18 and 3.26 million tonnes, following adjustments because of the price and transportation policy change. This represents a marginal decrease in canola production in western Canada in comparison to baseline production levels, of 0.06 million tonnes. In Alberta, canola production was estimated over the simulation period to decrease by 20.11 thousand tonnes and increase by as much as 150.74 thousand tonnes. Marginal impacts to Saskatchewan and Manitoba canola production is estimated to occur when compared to baseline simulation results. In Saskatchewan, canola production would decrease by 6.45 thousand tonnes and increase by 10.87 thousand tonnes over the simulation period. Manitoba canola production is estimated to decrease by 17.3 to 17.9 thousand tonnes, or by 3.11 to 4.4 percent.

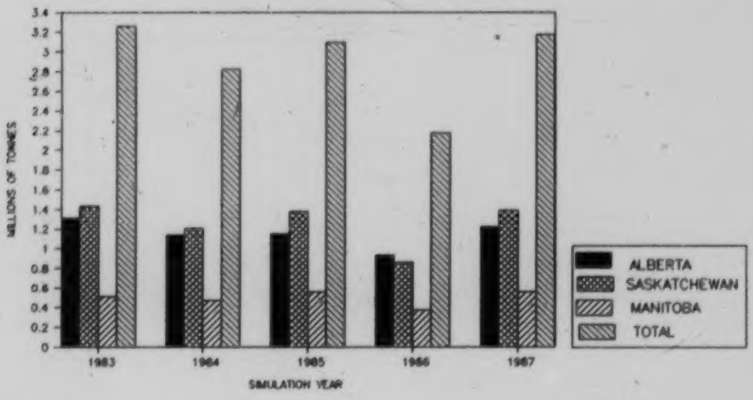


Figure VII.3: Adjusted Canola Production under Cost Scenario B-2

2. Producer Surplus (1983-1987)

Table VII.7 illustrates producer surplus on a provincial basis following adjustments to production. It was estimated that over the simulation period producer surplus would vary between 1.09 and 2.29 billion dollars in western Canada. With a change in the method of payment under St. Lawrence/Vancouver pricing and B-2 cost savings, producer welfare when compared to baseline producer surplus (Table IV.3) would decrease by 410 thousand dollars to 1.41 billion dollars over the simulation period. Regional impacts, however, differ between the three prairie provinces because of a price and transportation policy change.

In Alberta, returns to wheat producers given adjusted production levels would decrease by 37.92 to 64.32 million dollars from 1984 to 1987. In comparison to baseline producer welfare levels, wheat producers located in Alberta would experience an increase in net returns during the 1983-1984 crop year. Associated with the large decreases in barley production in Alberta are major decreases in farmers welfare when compared to the baseline analysis (Table IV.3). These decreases range from a low of 43.25 to 64.75 million dollars over the simulation period. This indicates benefits to livestock feeding within the province of Alberta. Canola returns in Alberta would also decrease after adjustments to production, when compared to baseline simulation results. The approximate magnitude of this decrease varies between 13.52 to 54.46 million dollars from 1983 to 1987.

In Saskatchewan, given a comparison to baseline producer welfare measures, farmers returns would decrease during the 1984-1985, 1985-1986 and 1987-1988 crop years by 49.52 to 108.49 million dollars. In 1983-1984 wheat returns for producers located in Saskatchewan would increase by 36.20 million dollars. Also during the 1986-1987 crop year Saskatchewan wheat returns would shift upwards by 51.08 million dollars. Barley returns within the province of Saskatchewan are estimated to decrease over the simulation when compared to estimated levels in the baseline scenario. These decreases range from a low of 41.18 to a high of 91.72 million dollars. Saskatchewan canola returns would also decrease during the simulation when compared to baseline levels, 29.58 to 44.69 million dollars.

Wheat returns when compared to baseline estimated levels are expected to decrease by 71.92 to 90.99 million dollars in Manitoba. Barley returns are also estimated to decrease in Manitoba over the simulated period, thus creating a benefit to livestock producers located in that province. The approximate magnitude of this decline ranges from 20.63 to 40.46 million dollars. Marginal decreases in Manitoba canola returns of 756.17 thousand dollars to 10.53 million dollars are estimated to occur during the simulated period.

TABLE VII.7: ADJUSTED PRODUCER SURPLUS (1983-1987)

('000 DOLLARS)

CROP YEAR

C.W.B. PROPOSAL UNDER PAY THE PRODUCER ALTERNATIVE WITH B-2 SAVINGS

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	79037.60	163382.36	136609.16	108064.98	32687.63
Wheat	529842.17	397402.21	312090.82	294454.72	173615.91
Canola	203465.96	162514.07	173824.67	87947.02	173307.74
SASKATCHEWAN					
Barley	49078.25	131855.94	117558.72	36564.48	18737.23
Wheat	798076.17	644219.48	505779.28	543232.53	280883.49
Canola	347168.73	266485.99	323653.03	99514.61	232293.24
MANITOBA					
Barley	19149.90	40723.74	34865.40	10267.83	3886.91
Wheat	206890.45	181077.49	212197.93	138246.26	97849.19
Canola	62075.95	59472.86	98627.11	35525.56	85959.47
PRAIRIES					
Total	2294785.1	2047134.1	1915206.1	1353818.0	1099220.8

3. Changes to Consumer Surplus (1983-1987)

Measuring the area between the fixed demand functions before and after a policy change, i.e related to the baseline scenario and pay the producer method of payment under St. Lawrence/Vancouver pricing, gives a measure for consumer surplus change. Overall, it is estimated that consumers would benefit by 441.71 to 783.34 million dollars from all grain purchases given the proposed changes in transportation and pricing policy. Consumers, i.e. livestock producers or foreign consumers are estimated to benefit approximately 160.78 to 249.67 million dollars from barley purchases in western Canada. The annual benefit to wheat consumers in the prairies was estimated to be approximately 215.52 to 400 million dollars over the simulated period. Foreign consumers could benefit by approximately 61.17 to 91.38 million dollars from purchases of canola in western Canada.

The largest impact on consumers of barley is estimated to occur in Alberta, where consumer surplus changed by 65.62 to 124.12 million dollars over the simulated period. In Saskatchewan the increase in consumer surplus for barley purchases was estimated to be approximately 43.98 to 81.25 million dollars. Manitoba consumers are estimated to incur a benefit ranging from 47.11 to 62.89 million dollars over the simulated period.

Saskatchewan and Manitoba consumers are estimated to incur large increases in consumer surplus over the simulated period. In Saskatchewan, consumer surplus increased by 99.61 to 283.98 million dollars from 1983 to 1987. Also, the benefit to consumers in Manitoba is 70.59 to 111 million dollars over the simulated period. In Alberta, this consumer benefit is estimated to range from 29.86 to 66.06 million dollars.

Relatively to wheat and barley, consumers purchasing canola in the three prairie provinces are estimated to incur marginal changes. In Alberta, consumer surplus would increase by 20.4 to 28 million dollars over the simulated period. Saskatchewan canola consumers would see a benefit from purchases of 22.8 to 37.5 million dollars. Also, in Manitoba, this benefit would range from 17.94 to 26.38 million dollars.

Summing the changes in consumer and producer surplus gives an approximate net welfare measure for each grain and region in western Canada. In total, net welfare for the prairie region is estimated to be changed by approximately 112.31 to 298.13 million dollars over the simulated period. This indicates a transfer of wealth from producers to consumers during the 1983 to 1987 crop years. In Alberta's barley economy, a decrease in net welfare amounting to 26.65 million dollars and a benefit of approximately 59.37 million dollars would occur during the same time frame. In the Alberta wheat economy, net welfare could range from a low of -18.51 to a high of 83.48 million dollars. The Alberta canola sector would experience a net welfare ranging from 5.15 to 10.90 million dollars. Regional net welfare effects in Saskatchewan for barley are estimated to range from a low of -43.77 to a high of 25.19 million dollars over the simulated period. The wheat economy in Saskatchewan is estimated to incur a net benefit of 48.24 to 204.93 million dollars. Canola in Saskatchewan is estimated from 1983 to 1987 to have a negative regional welfare change of 3.1 to 10.6 million dollars. In Manitoba, net welfare is expected to occur for each grain over the simulated period. In fact, barley regional welfare would range from 10.06 to 22.42 million dollars.

TABLE VII.8: CHANGES TO CONSUMER SURPLUS (1983-1987)

('000 DOLLARS)

CROP YEAR

C.W.B. PROPOSAL UNDER PAY THE PRODUCER ALTERNATIVE WITH B-2 SAVINGS

CROP	83/84	84/85	85/86	86/87	87/88
ALBERTA					
Barley	65611.34	73714.46	97829.67	124118.58	78060.24
Wheat	39824.77	32626.72	29864.20	66057.49	54132.33
Canola	23284.45	20404.61	23852.67	21993.84	28000.29
SASKATCHEWAN					
Barley	47956.65	43976.77	78166.36	81246.15	58828.40
Wheat	168731.51	99613.52	151347.52	283979.05	243012.40
Canola	28708.85	22823.70	34043.56	24396.17	37463.16
MANITOBA					
Barley	47109.06	50330.10	62885.98	44302.90	39344.10
Wheat	70591.50	83284.25	97253.07	111001.68	102860.60
Canola	18586.40	17938.94	26377.80	26247.24	25919.83
PRAIRIES					
Total	510404.53	444713.07	601620.85	783343.10	667621.35

Net regional welfare to the wheat sector during the simulated period in Saskatchewan is estimated to be 6 to 6.3 million dollars. Regional welfare levels to the Manitoba canola sector would range from 8.05 to 20.28 million dollars from 1983 to 1987.

4. Grain Flows (1983-1987)

From the adjusted production levels previously discussed, the amount of wheat and barley available to the export market can be determined. In Figure VII.4, the optimal transport patterns of wheat to export position is presented. It is estimated that approximately 8 to 17 million tonnes would flow more cost efficiently through the East Coast, as opposed to 2 to 8 million tonnes through the West Coast over the simulation period. The optimal transport route for adjusted wheat shipments from Alberta was estimated to be through Vancouver and/or Prince Rupert over the simulation period. An exception to these transport patterns occurred during the 1984 and 1985 crop years. In the 1984-1985 crop year, approximately 1.84 million tonnes of wheat from Alberta was transported via the eastern route, given competitive conditions in the western Canadian grains sector. Also, during the 1985-1986 crop year, wheat shipments from Alberta through the St. Lawrence via Thunder Bay was estimated at 410 thousand tonnes. In other words, the tonnage constraint at West Coast ports became binding during 1984 and 1985. In Saskatchewan, East Coast ports were estimated to be the more lucrative position for wheat from 1983 to 1985, approximately 9.3 to 10.1 million tonnes during this period. During the 1986 and 1987 crop years, 5.9 to 10.7 million tonnes of wheat from Saskatchewan, under competitive conditions, was estimated to be transported through Vancouver and/or Prince Rupert. All Manitoba wheat shipments would be transported to the eastern Canadian ports if the C.W.B.'s objective was to minimize transport costs.

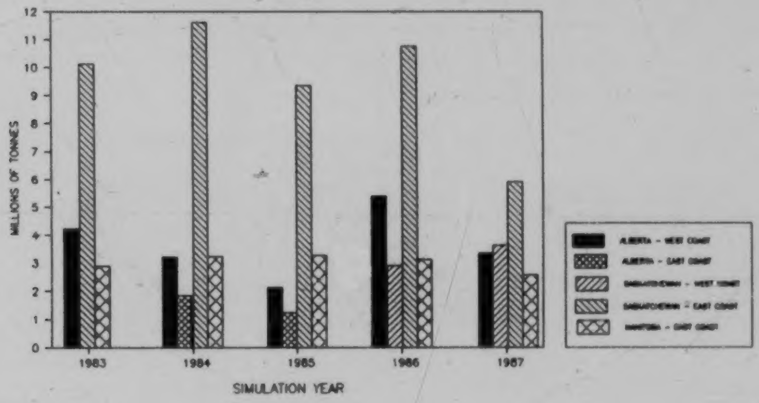


Figure VII.4: Wheat Transport Flows under Cost Scenario B-2

The West Coast ports would tend to be the more lucrative positions for barley exports in western Canada, following changes to the C.W.B. Act that led to the use of the St. Lawrence as a price basing point in the method of calculating producer freight costs. Over the simulation period, it was estimated that 3.8 to 6.8 million tonnes of barley would be transported through the West Coast, if the C.W.B. implemented its pricing proposal under a method of payment to producers and cost savings were identical to those in scenario B-2. Approximately 1.6 to 3.4 million tonnes of barley in western Canada would be transported to Eastern ports. The source for barley shipments at Thunder Bay over the simulation period is estimated to flow from Saskatchewan and Manitoba. Approximately 2.4 million tonnes of barley shipments at Thunder Bay were from Saskatchewan, whereas, 1.8 million tonnes came from Manitoba.

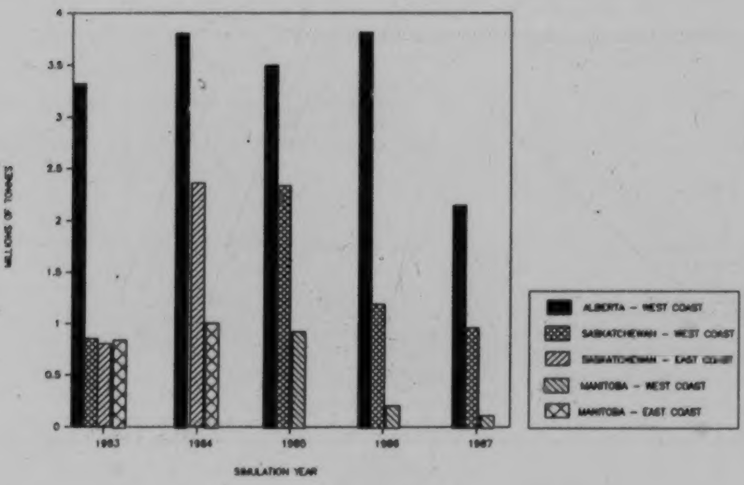


Figure VII.5: Barley Transport Flows under Cost Scenario B-2

5. Freight Costs (1983-1987)

Table VII.9 illustrates adjusted shipping costs to producers and the C.W.B., following a change in grain pricing and freight costing. It is estimated that producers would incur transport costs from all grain shipments ranging between 621.71 and 892.05 million dollars. On average, producers would pay $20.75 to $29.12 per tonne to ship wheat and $23.09 to $30.77 per tonne to transport barley to export position over the simulated period.

The C.W.B. shipment costs for all grains from 1983 to 1987 were estimated to range between 258.60 to 499.85 million dollars. On a per tonne basis, the C.W.B. would incur on average, a $12.34 to $23.33 per tonne freight charge from wheat shipments and $0.47 to $7.40 per tonne on barley shipments. The majority of total transportation costs to the C.W.B. occurs from Saskatchewan wheat shipments by approximately 148 to 331.73 million dollars. Also the C.W.B. would pay transportation costs for Manitoba barley amounting to 1.51 to 26.28 million dollars.

A comparison of shipping costs from the baseline analysis (Table IV.6) to adjusted freight costs found under St. Lawrence/Vancouver pricing under a method of payment to producers, results in producer freight costs increasing for all grains by 440.21 to 704.1 million dollars. It is estimated over the simulated period that producers would incur a $13.55 to $17.66 per tonne increase in transportation charges for wheat shipments. Barley transportation charges to producers were also estimated to increase over the simulated period, $17.56 to $17.93 per tonne. These producer freight charge increases are a direct result of changing the price basing point from Thunder Bay to the St. Lawrence and shifting the method of payment from the railway to producers.

In most years the C.W.B. would experience a decrease in transportation charges from grain shipments by implementing its pricing proposal while the federal Government changed the method of payment from railways to producers in western Canada. This decrease ranges from 43.47 to 89.23 million dollars. With the binding constraint at West Coast ports during the 1984-1985 crop year, the C.W.B. would incur an increase in shipment costs amounting to 2.6 million dollars. On a per tonne basis, wheat shipping costs to the C.W.B. are estimated to decrease by $1.26 to $6.29. During the 1984-1985 crop year, C.W.B. wheat shipping costs are expected to increase by $0.57 per tonne. It is estimated that a variation in barley shipping costs to the C.W.B. would occur when compared to baseline levels. For instance, C.W.B. costs from barley shipments would increase during the 1983 and 1985 crop years by $6.14 and $0.02 per tonne and decrease by $10.03 per tonne in 1984, $0.08 per tonne in 1986, and $0.30 per tonne in 1987. In most crop years, implementing the C.W.B. proposal under a change in the method of calculating freight charges causes a shift in marketing costs away from the C.W.B. to producers, thereby, recognizing locational advantage to those farmers located closest to the lower cost West Coast ports.[27]

---

[27] Adjusted freight costs to the C.W.B. on a sub regional basis are in Appendix D, Table D-1.

TABLE VII.9: ADJUSTED TRANSPORT COSTS WITH ST. LAWRENCE PRICING

(1983-1987) MILLIONS OF DOLLARS

PAY THE PRODUCER WITH CURRENT WEST COAST CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1983-1984					
Producer					
Wheat	93.23	240.40	53.33	392.97	22.80
Barley	77.27	41.43	15.63	134.33	23.09
Canola	31.05	38.21	15.35	84.61	25.96
Oats	6.73	2.14	0.94	9.81	27.00
Total	214.29	322.18	85.25	621.71	23.35
C.W.B.					
Wheat	-	155.27	57.50	212.77	12.34
Barley	-	19.72	20.86	40.57	6.97
Oats	-	1.30	0.73	5.26	14.49
Total	-	176.29	79.08	258.60	9.71
1984-1985					
Producer					
Wheat	133.04	216.71	63.02	412.78	20.75
Barley	89.02	65.86	19.68	174.55	24.79
Canola	27.88	33.20	17.34	78.43	27.78
Oats	5.91	1.01	1.09	8.01	28.36
Total	255.85	316.78	101.13	673.76	22.47
C.W.B.					
Wheat	40.43	331.73	71.21	443.38	22.29
Barley	-	25.81	26.28	52.09	7.40
Oats	2.89	0.63	0.87	4.38	15.51
Total	43.32	358.17	98.36	499.84	16.67

...Continued

TABLE VII.9: *con't* **ADJUSTED TRANSPORT COSTS WITH ST. LAWRENCE PRICING (1983-1987) MILLIONS OF DOLLARS**

PAY THE PRODUCER WITH CURRENT WEST COAST CONDITIONS

Crop Year	Alberta	Sask.	Manitoba	Total	Per Tonne
1985-1986					
Producer					
Wheat	127.44	256.13	70.52	454.09	28.45
Barley	94.67	72.76	27.26	194.69	28.69
Canola	31.27	41.94	22.72	95.93	31.02
Oats	5.23	1.54	1.62	8.39	29.64
Total	258.61	372.36	122.11	753.09	28.91
C.W.B.					
Wheat	56.79	233.80	81.84	372.43	23.33
Barley	-	-	10.55	10.55	1.55
Oats	2.43	0.93	1.19	4.56	16.11
Total	59.21	234.74	93.58	387.54	14.88
1986-1987					
Producer					
Wheat	160.65	410.17	74.68	645.49	29.12
Barley	113.88	40.19	6.86	160.93	30.77
Canola	28.00	28.85	16.94	73.80	33.82
Oats	8.14	2.13	1.56	11.83	34.13
Total	310.67	481.34	100.04	892.05	29.87
C.W.B.					
Wheat	-	245.12	71.21	316.33	14.27
Barley	-	-	2.66	2.66	0.51
Oats	3.51	1.22	1.08	5.81	16.76
Total	3.51	246.33	74.95	324.80	10.88
1987-1988					
Producer					
Wheat	98.29	287.64	60.33	446.26	28.86
Barley	63.02	31.93	3.90	98.86	30.47
Canola	36.27	45.75	24.68	106.69	33.61
Oats	8.01	2.09	1.53	11.64	33.57
Total	205.59	367.41	90.45	663.45	29.94
C.W.B.					
Wheat	-	148.00	64.58	212.58	13.75
Barley	-	-	1.51	1.51	0.47
Oats	3.86	1.33	1.19	6.38	18.40
Total	3.86	149.33	67.28	220.47	9.95

VIII. MISSISSIPPI RIVER ALTERNATIVE

Up to this point, discussions on domestic grain pricing have been in the context of an all-Canadian grain export route (West Coast ports, and the Great Lakes ports and the St. Lawrence Seaway System). The institutional arrangements (government policies related to rail subsidies and port facility infrastructure) in the grain sector have traditionally led to grain exports through these Canadian ports. Major changes in government transportation policies have taken place modifying this environment. Among these changes was the passage of the Western Grain Transportation Act in 1983, "to facilitate the transportation, shipping and handling of western grain".[28] The Federal Government, under this act, pays the annual Crow Benefit directly to the railways, and through a cost - share system with producers of eligible commodities, shippers pay the first 6 percent of rail freight costs. This increase in grain transportation rates set under the W.G.T.A. led to interest in the Mississippi River system as a viable alternative export route.

The export route for this movement is assessed by Gemmell (1987), for the 1985-1986 crop year. It is assumed that grain would be loaded into barges from rail cars at a facility in St. Paul, Minnesota. The grain would travel down the Mississippi river to Baton Rouge, Louisiana where it would be loaded into an ocean vessel. To get to St. Paul, it is hypothesized that the grain would travel by rail from a Canadian interchange point (Winnipeg).[29] Since producer prices are determined in the current study by subtracting the transportation rates from a central point in each sub region to the nearest export port. It follows from this that assessing the Mississippi alternative must also take into account freight costs from each central point to Winnipeg.

During the 1985-1986 crop year producers paid on average $7.00/tonne to transport their grain under current W.G.T.A. freight rates. Barge costs from St. Paul to Baton Rouge and terminal costs at St. Paul amounted to $23.80/tonne during 1985-1986. This suggests that the Mississippi River would be a feasible alternative only under a method of payment change. The Mississippi River alternative, therefore, is only considered in the context of full rail freight rates being paid directly by producers.

---

[28] Grain Transportation Agency, Review of the Western Grain Transportation Act, April, 1986, pp.8.

[29] It is recognized that there exists numerous interchange points in western Canada for grain transportation to the United States.

It is assumed that the C.W.B. will recognize the Mississippi River as a viable export route for Canadian grains, that is, prices will be based in store at Thunder Bay, Vancouver, and the Mississippi. Producers freight rates will be based on transportation of grains to one of these three ports, whichever is lowest. In the case of the C.W.B.'s new pricing proposal, the St. Lawrence seaway will replace Thunder Bay as a price basing point, therefore, producers freight costs are the lowest of St. Lawrence/Vancouver/Mississippi ports.

A. Initial Responses to Grain Policies

1. Production Responses (1985-1986)

Table VIII.1 shows initial production results for the 1985-1986 crop year, using St. Lawrence/Vancouver/Mississippi pricing and pay the producer method of paying freight charges. Comparison of production of spring wheat, feed barley, and canola to initial production estimated under Thunder Bay/Vancouver pricing with pay the producer method of payment shows a decline of 3.7 percent in total production. The 3.7 percent consists of 638.9 thousand tonnes of spring wheat, 361.5 thousand tonnes of feed barley, and 36.3 thousand tonnes of canola.

Production of wheat, barley, and canola in Alberta in these two scenarios is equivalent because producers pay a similar freight rate charge to export their grain. In Saskatchewan, production of barley would decrease by approximately 100 thousand tonnes during the 1985-1986 crop year. Also wheat production is estimated to decrease by 184 thousand tonnes. But canola production in Saskatchewan would increase by 4 thousand tonnes, given the low positive cross price effects. Major impacts in wheat and barley production in the province of Manitoba are estimated to occur by introducing a third export position, under a method of payment change. Barley would decrease by 261.2 thousand tonnes and wheat is estimated to decrease by 455 thousand tonnes. Marginal decreases in Manitoba canola production are estimated to occur during the 1985-1986 crop year of 4.5 thousand tonnes.

On a provincial basis a change in total welfare varies between $57.8 million in Manitoba to $111 million in Manitoba for all grain. In Manitoba and Saskatchewan changing grain output led to declines in total producer welfare of approximately 162 million dollars in Manitoba and 286 million dollars in Saskatchewan. The net welfare gain in western Canada under St. Lawrence/Vancouver/Mississippi pricing involves a transfer of wealth from producers to consumers. In fact, consumer surplus increased by 249 million dollars in Manitoba to 393 million dollars in Saskatchewan. From Table VIII.1, barley consumers, livestock producers. in Manitoba would gain 24 million dollars by changing the method of payment under St. Lawrence/Vancouver pricing. This represents a 1.03 million dollar decrease over Thunder Bay/Vancouver pricing while producers would pay the full W.G.T.A. rate to ship their product.

TABLE VIII.1: INITIAL PRODUCER RESPONSE

Region	Quantity Supplied ('000 Tonnes)	Producer Surplus Change[30] ('000$)	Consumer Surplus Change[31] ('000$)	Net Welfare Change ('000$)
ALBERTA				
Barley	4558	-	-	-
Wheat	3029	-	-	-
Canola	1095	-	-	-
SASKATCHEWAN				
Barley	2674	(84187)	89945	5758
Wheat	8922	(156916)	269475	112559
Canola	1379	(44682)	33910	(10772)
MANITOBA				
Barley	1604	(42861)	66955	24094
Wheat	3140	(112646)	156649	44003
Canola	543	(6910)	25857	18947
PRAIRIES				
Total	26944	(448202)	642791	194589

2. Optimal Grain Shipment Patterns (1985-1986)

---

[30] Producer Surplus Change. The change in producer surplus is determined by comparing Thunder Bay/Vancouver pricing to St. Lawrence/ Vancouver/ Mississippi pricing under pay the producer method of payment.

[31] Consumer Surplus Change. The change in consumer surplus is measured by a similar method to that of producer surplus change.

Exports from all sub regions, determined from the local supply functions and demand levels, are then used as export quantities in determining trade flows to the three export positions. Table VIII.2 shows initial optimal grain trade patterns when movements through the U.S. were permitted, under both Thunder Bay/Vancouver and St. Lawrence/Vancouver pricing, together with producers paying the full cost of shipping grain set under the W.G.T.A. This initial run was considered in the context of restricting West Coast shipments to the actual Prince Rupert/Vancouver marketing conditions during the 1985 - 1986 crop year (12 million tonnes).[32] Under Thunder Bay/Vancouver/Mississippi pricing, approximately 53 percent of grain shipments are diverted down the Mississippi River, while 46 and one percent are shipped through the West Coast ports and Thunder Bay, respectively.[33]

It was found that increasing West Coast capacity to a level estimated by the C.W.B. (20 million tonnes) under Thunder Bay/Vancouver/Mississippi pricing 8 million tonnes would be diverted from the Mississippi River to Vancouver and/or Prince Rupert (Table VIII.3). Constituting this 8 million tonnes is 6.54 million tonnes of wheat, and 1.31 million tonnes of barley from Saskatchewan.

When West Coast capacity is increased to 20 million tonnes under St. Lawrence/Vancouver/Mississippi pricing, approximately 8.6 million tonnes are diverted away from the Mississippi River to West Coast ports. There is a slight change in trade patterns when compared to the 12 million tonne West Coast restriction, that is, all Alberta and Saskatchewan wheat are shipped through Vancouver or Prince Rupert, no Manitoba shipments move via the Mississippi

---

[32] This marketing condition during 1985-1986 crop year also reflects the production conditions during that same year.

[33] Grain trade flows under St. Lawrence/Vancouver/Mississippi pricing are similar to those flows found under Thunder Bay/Vancouver/Mississippi pricing. The difference between the three pricing alternatives occurs in the context that less grain is shipped initially under St. Lawrence/Vancouver/ Mississippi pricing due to producers response to this new pricing mechanism.

TABLE VIII.2: OPTIMAL GRAIN SHIPPING PATTERNS

Millions of Tonnes

REGION	WHEAT	BARLEY	CANOLA	OATS	TOTAL	%
12 MILLION TONNE WEST COAST CONSTRAINT						
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING						
WEST COAST						
ALBERTA	3.02	3.50	1.12	0.02	7.66	98.00
SASKATCHEWAN	1.59	0.81	1.38	-	3.78	28.97
MANITOBA	0.34	0.61	0.26	0.02	1.23	10.22
TOTAL	4.61	4.31	3.04	0.02	12.00	45.75
MISSISSIPPI						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	7.51	1.70	-	-	9.21	70.57
MANITOBA	3.60	1.15	-	-	4.75	88.29
TOTAL	10.46	2.50	-	-	13.96	53.22
EAST COAST						
ALBERTA	-	-	-	0.14	0.14	2.00
SASKATCHEWAN	-	-	-	0.05	0.05	0.46
MANITOBA	-	-	-	0.08	0.08	1.49
TOTAL	-	-	-	0.27	0.01	1.03
ST. LAWRENCE/VANCOUVER/MISSISSIPPI PRICING						
WEST COAST						
ALBERTA	3.02	3.51	1.12	0.02	7.66	98.00
SASKATCHEWAN	1.59	1.51	1.38	0.02	3.80	29.03
MANITOBA	-	-	0.54	-	0.54	10.22
TOTAL	4.61	4.24	3.04	0.04	12.00	45.75
MISSISSIPPI						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	7.32	1.61	-	-	9.21	70.36
MANITOBA	3.14	0.89	-	-	4.75	80.29
TOTAL	11.11	2.85	-	-	13.96	53.22
EAST COAST						-
ALBERTA	-	-	-	0.14	0.14	0.61
SASKATCHEWAN	-	-	-	0.05	0.06	1.49
MANITOBA	-	-	-	0.08	0.08	1.03
TOTAL	-	-	-	0.27	0.27	1.03

TABLE VIII.3: GRAIN SHIPPING PATTERNS - INCREASED CAPACITY

Millions of Tonnes

REGION	WHEAT	BARLEY	CANOLA	OATS	TOTAL	%
20 MILLION TONNE WEST COAST CONSTRAINT						
THUNDER BAY/VANCOUVER PRICING						
WEST COAST						
ALBERTA	3.02	3.50	1.12	0.16	7.80	100.00
SASKATCHEWAN	8.13	2.14	1.53	0.01	11.65	80.85
MANITOBA	-	-	0.55	-	0.55	10.38
TOTAL	11.15	5.62	3.06	0.17	20.00	76.25
MISSISSIPPI						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	0.97	0.39	-	-	1.36	9.44
MANITOBA	3.60	1.15	-	-	4.75	89.62
TOTAL	4.57	1.54	-	-	6.11	23.29
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	0.97	0.39	-	0.04	1.40	9.72
MANITOBA	-	-	-	-	-	-
TOTAL	-	-	-	0.12	0.12	0.46
ST. LAWRENCE/VANCOUVER PRICING						
WEST COAST						
ALBERTA	3.02	3.51	1.12	0.16	7.67	100.00
SASKATCHEWAN	8.17	2.08	1.55	0.07	11.65	91.16
MANITOBA	-	-	0.54	-	0.54	10.54
TOTAL	11.19	5.58	3.04	0.17	20.00	81.97
MISSISSIPPI						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	3.88	1.23	-	-	1.08	8.45
MANITOBA	0.74	0.89	-	-	4.03	87.74
TOTAL	3.88	1.23	-	-	4.37	17.84
EAST COAST						
ALBERTA	-	-	-	-	-	-
SASKATCHEWAN	-	-	-	0.05	0.05	0.39
MANITOBA	-	-	-	0.08	0.08	1.72
TOTAL	-	-	-	0.13	0.13	0.19

River. The result is that approximately 18 percent of western grain would flow efficiently down the Mississippi River if the C.W.B. implemented its new proposal under a 20 million tonne West Coast restriction with producers paying full freight charges.[34]

---

[34] Fruin and Dickerson (1986) developed a linear programming cost minimization trans-shipment model for the 1984-1985 crop year to determine if the Mississippi River is a viable export position for Canadian grains. Their findings suggest that it would have been advantageous to ship as much as 10 percent of Canadian export grain by barge to Mississippi River Gulf ports--even with crow rates in effect. This also included a 10 million tonne restriction at West Coast ports.

3. Shipping Costs (1985-1986)

Given the least cost shipment patterns discussed previously, shipping costs to producers, the C.W.B., and total system costs can than be determined.[35] With actual production and marketing conditions representing West Coast capacity, Table VIII.4, reports the breakdown of these shipping costs on a provincial basis. A situation of Thunder Bay/Vancouver pricing and actual production and marketing conditions representing West Coast capacity results in the C.W.B. paying $16.82/tonne on average to ship wheat to a designated export position. These C.W.B. costs represent the difference between the actual freight rate and the deducted freight rate to producers.

Shipping costs for barley are substantially less than those of wheat, given that 7.2 million tonnes were exported during the simulated 1985-1986 crop year as compared to 16 million tonnes of wheat. Costs to the C.W.B. for barley shipments are the largest in Saskatchewan, amounting to 40 million dollars. If competitive conditions are maintained in the western Canadian grains sector and total shipment costs are to be minimized under a West Coast tonnage restriction of 12 million tonnes, then the C.W.B. would pay $9.50/tonne on average to ship barley designated for export.

Canadian Wheat Board costs for exports of oats are 5.16 million dollars under cost minimization conditions, reflecting the minor importance of this commodity in the western Canadian grains and oilseeds economy (Table VIII.4). Producer shipment costs for oats range from a low of 1.6 million dollars in Manitoba, to a high of 4 million dollars in Alberta.

---

[35] Under a change in the method of paying freight rates, the total system includes the C.W.B. and primary grain producers.

TABLE VIII.4: PROVINCIAL BREAK-DOWN ON SHIPPING COSTS

Millions of Dollars

PRODUCER COSTS

THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
Alberta	81.67	94.22	30.60	4.06	210.55
Saskatchewan	248.48	70.29	42.12	1.54	362.42
Manitoba	77.51	24.87	22.34	1.62	126.34
Total	407.66	189.37	95.07	7.21	699.31
Per Tonne	25.92	26.41	31.03	25.48	26.72
C.W.B COSTS					
Alberta	-	-	-	3.03	3.03
Saskatchewan	179.05	40.63	-	0.94	220.61
Manitoba	85.57	27.45	-	1.19	114.21
Total	264.62	68.08	-	5.16	337.86
Per Tonne	16.82	9.49	-	18.25	12.91
TOTAL SYSTEM COSTS					
Alberta	81.67	94.22	30.60	7.09	213.58
Saskatchewan	427.53	110.91	42.12	2.47	583.04
Manitoba	163.08	52.32	22.34	2.81	240.55
Total	672.28	257.45	95.07	12.37	1037.2
Per Tonne	42.74	35.91	31.03	43.73	39.63

The C.W.B. is not responsible for any added costs incurred in canola shipments, since this crop is a non-Board grain. Costs of shipping canola under this method of payment change is the responsibility of the producer. Producer costs of canola shipments averaged $31/tonne during the 1985-1986 crop year under Thunder Bay/Vancouver/Mississippi pricing and a 12 million tonne West Coast export restriction. The linear programming transportation sub model restricts shipments of canola to West Coast ports resulting in producer costs of 22, 31, and 42 million dollars in Manitoba, Alberta, and Saskatchewan respectively.

A provincial summary of grain shipping costs under St. Lawrence/Vancouver/Mississippi pricing with actual production and marketing conditions representing West Coast capacity is shown in Table VIII.5. Costs to the C.W.B. on wheat shipments under their new pricing proposal with actual production and marketing conditions representing West Coast capacity decline to 133 million dollars in Saskatchewan and $14 million in Manitoba. Under St. Lawrence/Vancouver/Mississippi pricing the C.W.B. pays on average $9.75/tonne to ship wheat.

TABLE VIII.4: *Con't* **PROVINCIAL BREAK-DOWN ON SHIPPING COSTS**

Millions of Dollars

PRODUCER COSTS

ST. LAWRENCE/VANCOUVER/MISSISSIPPI PRICING

PRODUCER COSTS					
Alberta	81.67	94.22	30.60	4.06	210.55
Saskatchewan	285.41	75.24	41.94	1.75	404.33
Manitoba	128.13	36.42	22.17	2.81	189.53
Total	495.21	205.87	94.71	8.62	804.41
Per Tonne	32.82	30.24	31.02	30.45	31.97
C.W.B COSTS					
Alberta	-	-	-	2.87	2.87
Saskatchewan	132.77	30.61	-	0.63	164.00
Manitoba	14.29	4.06	-	-	18.35
Total	147.05	341.67	-	3.49	185.21
Per Tonne	9.75	5.09	-	12.34	7.36
TOTAL SYSTEM COSTS					
Alberta	81.67	94.22	30.60	6.93	213.42
Saskatchewan	418.18	105.85	41.94	2.37	568.33
Manitoba	142.41	40.48	22.18	2.81	207.87
Total	642.27	240.54	94.71	12.11	989.63
Per Tonne	42.56	35.33	31.02	42.80	39.33

The C.W.B., under their new pricing proposal and 1985-1986 marketing and production conditions representing West Coast capacity, would pay approximately $5/tonne to ship barley to the three export positions. Estimates from the production simulation and transportation sub models indicate barley shipping costs to the Canadian Wheat Board to be the greatest in the province of Saskatchewan, 31 million dollars. Major declines are experienced in the province of Manitoba where C.W.B. costs of barley shipments decline from 27 million to 4 million dollars, reflecting the location of this province to the higher premium market. This decline in C.W.B. costs in the province of Manitoba is not only associated with increased freight rates but is due to a decline in barley exports from that region, 23 percent. A major decline in C.W.B. costs associated with oats exports, occurs in the province of Manitoba, where costs decline to zero. Other Board costs in exporting oats are marginal, under a 12 million tonne West Coast restriction with St. Lawrence/Vancouver/Mississippi pricing, (see Table VIII.5).

An increase in West Coast capacity to a level estimated by the C.W.B. (20 million tonnes) under Thunder Bay/Vancouver/Mississippi pricing results in a decline in C.W.B. costs, totalling $7.14/tonne for all grain (Table VIII.6). The major cost to the C.W.B. by increasing West Coast capacity under Thunder Bay/Vancouver/Mississippi pricing occurs in wheat. This increase occurs in the provinces of Manitoba and Saskatchewan and amounts to 86 million dollars, and 58 million dollars respectively.

TABLE VIII.5: GRAIN SHIPPING COSTS - INCREASED CAPACITY

Millions of Dollars

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING					
C.W.B. COSTS					
Alberta	-	-	-	-	-
Saskatchewan	57.74	14.20	-	0.81	72.74
Manitoba	85.57	27.45	-	1.19	114.21
Total	143.30	41.65	-	2.00	186.96
Per Tonne	9.11	5.81	-	7.07	7.14
TOTAL SYSTEM COSTS					
Alberta	81.67	94.22	30.60	4.06	210.55
Saskatchewan	306.22	84.48	42.12	2.34	435.17
Manitoba	163.08	52.32	22.34	2.81	240.55
Total	550.97	231.02	95.07	9.21	886.27
Per Tonne	35.03	32.22	31.03	32.55	33.86
ST. LAWRENCE/VANCOUVER/MISSISSIPPI PRICING					
C.W.B. COSTS					
Alberta	-	-	-	2.86	2.86
Saskatchewan	11.22	5.11	-	0.50	16.85
Manitoba	14.29	4.06	-	-	18.35
Total	25.50	9.17	-	3.36	38.04
Per Tonne	1.69	1.35	-	11.88	1.51
TOTAL SYSTEM COSTS					
Alberta	81.67	94.22	30.60	6.93	213.42
Saskatchewan	296.63	80.35	41.94	2.24	421.16
Manitoba	142.41	40.48	22.18	2.81	207.87
Total	520.71	215.05	94.71	11.98	842.45
Per Tonne	34.51	31.58	31.02	42.33	33.49

St. Lawrence/Vancouver/Mississippi pricing, with a 20 million tonne West Coast capacity restriction, results in the C.W.B. paying 11.2 million dollars on Saskatchewan wheat shipments, given that the optimal shipment pattern is through Prince Rupert and/or Vancouver (Table VIII.7). Costs to the C.W.B. for wheat shipments from Manitoba decline to 14 million dollars, due to the shift in trade patterns to the West Coast for this crop. Overall C.W.B. costs per tonne to ship wheat decline from $9.10 (Thunder Bay/Vancouver/Mississippi pricing) to $1.51 (St. Lawrence/ Vancouver/Mississippi pricing) under a 20 million tonne restriction, the difference reflecting the change in pricing policy.

Barley shipping costs to the C.W.B. decline under a 20 million tonne restriction and by changing pricing points to the St. Lawrence and the Mississippi River. The result is a decline ranging from $5.81/tonne to $1.35/tonne for these barley shipments. The final transport costs for barley to the C.W.B. is 5.1 million dollars in Saskatchewan and 4.06 million dollars in Manitoba.

4. Range in Cost Savings after Policy Implementation

The efficiency effects of introducing the new C.W.B. proposal, a method of payment change, and the Mississippi River alternative are analyzed in this section. These effects are only in terms of cost savings, therefore, the different policy options and constraint levels are compared. These cost comparisons consist of the following scenarios:

C-1 St. Lawrence/Vancouver/Mississippi pricing to Thunder Bay/Vancouver/Mississippi pricing with producers paying the full cost to ship their grain, while actual production and marketing conditions represent West Coast capacity.

C-2 St. Lawrence/Vancouver/Mississippi pricing under estimated West Coast capacity by the C.W.B. to Thunder Bay/Vancouver/Mississippi pricing, under actual production and marketing levels representing West Coast capacity.

C-3 St. Lawrence/Vancouver/Mississippi pricing to Thunder Bay/Vancouver pricing, all under pay the producer method of payment with actual production and marketing levels representing West Coast capacity.

C-4 St. Lawrence/Vancouver/Mississippi pricing under pay the producer method of payment, to Thunder Bay/Vancouver pricing, with pay the railway method of paying freight rates, all under actual marketing and production conditions representing West Coast capacity.

Tables VIII.8 through VIII.11 illustrate total cost savings and/or increases on a provincial basis under the four cost comparisons. These cost comparisons show total cost savings to the C.W.B. for wheat between $7.79/tonne (under scenario C-1) and $40/tonne (under scenario C-4). The Canadian Wheat Board is expected to experience an increase in barley shipment costs under scenario C-4 of $3.32/tonne and an increase of $4.91 to $8.65/tonne given the remaining comparisons. The model estimates a savings to the C.W.B. for oats shipments between $5.90/tonne (scenario C-1) and $27.96/tonne (scenario C-4). The C.W.B. on average saves between $6.05/tonne and $23.73/tonne on all grain shipments given the four cost comparison scenarios.[36]

TABLE VIII.6: TOTAL COST SAVINGS (INCREASES) UNDER COST SCENARIO C-1

Millions of Dollars

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER INCREASES					
Alberta	-	-	-	-	-
Per Tonne	-	-	-	-	-
Saskatchewan	-36.93	-4.95	0.19	-0.21	-41.91
Per Tonne	-4.14	-2.05	0.13	-3.81	-3.28
Manitoba	-50.62	-11.55	0.17	-1.19	-63.19
Per Tonne	-16.12	-12.94	0.31	-15.95	-13.59
Total	-87.55	-16.50	0.35	-1.41	-105.1
Per Tonne	-5.80	-2.42	0.12	-4.97	-4.17
C.W.B SAVINGS					
Alberta	-	-	-	1.67	-
Per Tonne	-	-	-	1.09	-
Saskatchewan	46.28	10.02	-	0.31	-41.91
Per Tonne	5.19	4.14	-	5.58	-3.28
Manitoba	71.28	23.39	-	1.19	-63.19
Per Tonne	22.70	26.21	-	15.95	-13.59
Total	117.56	33.41	-	1.67	-105.1
Per Tonne	7.79	4.91	-	5.90	-4.17
SYSTEM SAVINGS					
Alberta	-	-	-	1.67	1.67
Per Tonne	-	-	-	1.09	0.02
Saskatchewan	9.35	5.06	0.19	0.98	14.70
Per Tonne	1.05	2.09	0.13	1.77	1.15
Manitoba	20.66	11.84	0.17	-	32.68
Per Tonne	6.58	13.27	0.31	-	7.03
Total	30.02	16.91	0.35	2.64	47.55
Per Tonne	1.99	2.48	0.12	0.93	1.88

---

[36] It should be noted that producer cost increases remain the same under cost scenarios C-1 through C-3 because transportation costs are equivalent under each cost scenario. Producer costs change under scenario C-4.

TABLE VIII.7 TOTAL COST SAVINGS UNDER COST SCENARIO C-2

Millions of Dollars

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
C.W.B SAVINGS					
Alberta	-	-	-	3.03	3.03
Per Tonne	-	-	-	19.88	0.39
Saskatchewan	167.83	35.51	-	0.44	203.79
Per Tonne	18.81	14.67	-	7.93	15.95
Manitoba	71.28	23.39	-	91.19	95.87
Per Tonne	22.70	26.21	-	15.95	20.62
Total	239.11	58.91	-	4.67	302.69
Per Tonne	15.84	8.65	-	16.49	11.99
SYSTEM SAVINGS					
Alberta	-	-	-	3.03	3.03
Per Tonne	-	-	-	19.88	0.39
Saskatchewan	130.81	30.56	0.19	0.23	161.79
Per Tonne	14.66	12.63	4.12	4.12	17.66
Manitoba	20.66	11.84	0.17	-	32.68
Per Tonne	6.58	13.27	0.31	-	7.03
Total	151.47	42.41	0.35	3.26	197.47
Per Tonne	10.04	6.23	0.12	11.52	7.83

TABLE VIII.8 TOTAL COST SAVINGS UNDER COST SCENARIO C-3

Millions of Dollars

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
C.W.B SAVINGS					
Alberta	-	-	-	0.17	0.17
Per Tonne	-	-	-	1.09	0.02
Saskatchewan	55.45	22.79	-	0.31	78.55
Per Tonne	6.22	9.41	-	5.58	6.15
Manitoba	75.67	32.02	-	1.19	108.88
Per Tonne	24.10	35.88	-	15.95	15.95
Total	131.12	54.81	-	1.67	187.59
Per Tonne	8.69	8.05	-	5.90	7.43
SYSTEM SAVINGS					
Alberta	-	-	-	0.17	0.17
Per Tonne	-	-	-	1.09	0.02
Saskatchewan	18.52	17.84	0.18	0.98	36.64
Per Tonne	2.08	7.37	0.13	1.77	2.87
Manitoba	25.05	20.47	0.17	-	45.69
Per Tonne	7.98	22.94	0.31	-	9.83
Total	43.57	38.31	0.35	0.26	82.49
Per Tonne	2.89	5.63	0.12	0.93	3.27

TABLE VIII.9 TOTAL COST CHANGES UNDER SCENARIO C-4

Millions of Dollars

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
PRODUCER INCREASES					
Alberta	54.42	70.16	23.88	3.19	151.65
Per Tonne	17.97	20.07	21.12	20.94	19.42
Saskatchewan	203.88	33.58	17.68	1.42	256.56
Per Tonne	24.92	13.87	12.82	25.50	21.32
Manitoba	110.78	(0.96)	(0.92)	2.46	111.37
Per Tonne	35.28	(1.07)	(1.69)	32.90	23.95
Total	369.09	102.78	40.64	7.07	519.59
Per Tonne	25.72	15.10	13.31	25.00	21.21
C.W.B SAVINGS					
Alberta	156.16	-	-	6.80	162.95
Per Tonne	51.56	-	-	44.57	20.87
Saskatchewan	446.62	(2.14)	-	1.65	446.13
Per Tonne	54.60	(0.88)	-	29.62	37.07
Manitoba	143.65	5.01	-	2.46	151.12
Per Tonne	45.75	5.61	-	32.90	32.50
Total	746.436	2.87	-	10.91	760.20
Per Tonne	52.02	0.42	-	38.55	31.04
SYSTEM SAVINGS					
Alberta	101.74	(70.16)	(23.88)	3.61	11.30
Per Tonne	33.59	(20.07)	(21.12)	23.63	1.45
Saskatchewan	242.74	(35.72)	(17.68)	0.23	189.57
Per Tonne	29.68	(14.75)	(12.82)	4.12	15.75
Manitoba	32.87	5.97	0.92	-	39.75
Per Tonne	20.03	1.95	1.69	-	8.55
Total	377.35	99.91	40.64	3.84	240.61
Per Tonne	20.03	14.68	13.31	13.55	9.83

These overall cost savings to the C.W.B. represent revenues to each particular pool account, causing a benefit to those primary producers located near the West Coast market. It is estimated that Saskatchewan wheat producers would receive an increase in farm gate prices between $0.03/tonne and $14.96/tonne. The province of Manitoba's location to the higher West Coast market results in wheat returns declining (except in the C-4 scenario) between $0.28/tonne and $11.95/tonne. Manitoba wheat producers under cost scenario C-4 would experience an increase of approximately $6.27/tonne in farm gate returns.

Barley producers in Saskatchewan after implementation of the new C.W.B. pricing proposal under scenarios C-1 through C-3, will gain approximately $2.86 to $6.60 per tonne. Under the cost comparison scenario C-4, barley producers located in Saskatchewan are estimated to incur a $13.45

per tonne decline in returns. Manitoba barley producers, under each cost scenario during the simulated 1985-1986 crop year, would experience a decline in returns, except under scenario C-4. This loss in barley returns to Manitoba producers would range from a low of $4.29/tonne to a high of $8.03/tonne. This indicates positive gains to the livestock industry in the province of Manitoba, that is, creation of a benefit to domestic purchases of feed grain from this province.

Alberta producers, however, receive the total C.W.B. cost savings, due to freight costs remaining the same in scenarios C-1 and C-3. It is expected that farm gate returns to Alberta wheat producers would increase by $34.05/tonne and barley returns would decline by $19.65/tonne under scenario C-4 due to a change in transportation costs.

This analysis shows total transport cost changes to producers and the C.W.B., when a new pricing proposal is introduced, with the use of the Mississippi River along with changes in the mechanism by which W.G.T.A. pays grain freight rates. Efficiency effects due to these policy changes are three fold:

1. Change in base pricing point to St. Lawrence from Thunder Bay, while considering a third export route for Canadian grain, Mississippi.
2. The method of paying rail subsidies, from the railway to producers.
3. Increasing West Coast capacity from 12 million tonnes to a situation of a export constraint of 20 million tonnes.

B. Policy Adjustments (1985-1986)

Since grain receipts from shipments designated for export, are pooled, C.W.B. savings are reflected back into producer prices, thus representing an adjusted producer price. This adjusted price is then used as the supply inducing price in all sub regional responses to determine final production, export quantities for export, and transportation costs. The final gains and/or losses to the Canadian grains sector are calculated also from these adjusted sub regional supply functions.

1. Adjusted Production (1985-1986)

Figure VIII.1 illustrates the level of adjusted production for spring wheat, feed barley and canola for the western Canadian grains economy, and for each sub region.

This adjusted production reflects the efficiency effects determined by comparing changes in pricing grain, and methods of paying freight charges. Spring wheat, given estimates from the production simulation sub model, would range from a low of 16 million tonnes to a high of 20 million tonnes, while barley production would vary by 8 and 9 million tonnes. Canola production, given the policy changes, would vary by 3 and 3.3 million tonnes. It is estimated that western Canadian total grain production because of changes to grain pricing and freight costing would range between 28.1 to 30.7 million tonnes. A comparison of adjusted production results to initial levels in Table VIII.1, show grain production increasing by 4.5 to 14 percent because of the implementation of the new C.W.B. proposal plus a change in the freight costing mechanism, all under the Mississippi River alternative. Most of this increase occurs in wheat production, which amounts to a 6.7 to 33 percent increase. Barley production, on the other hand, could decline by as much as 9 percent or increase by approximately 2 percent. Canola production would increase between 0.4 to 11 percent, (Figure VIII.1 and Table VIII.1). These approximate magnitudes suggest that grain producers would have a tendency to shift plantings away from the lower value, bulky crop, barley, to the higher value, less bulky crops, of wheat and canola.

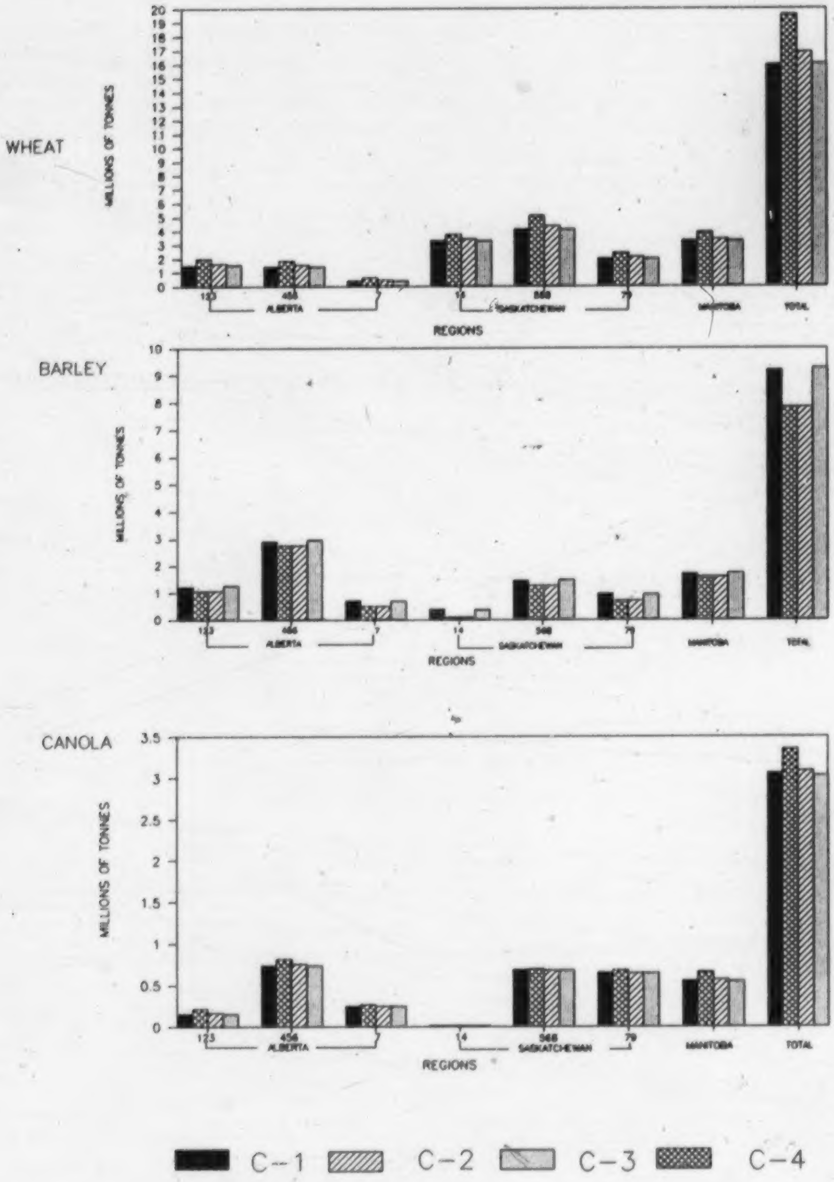


Figure VIII.1: Adjusted Production under each Scenario

TABLE VIII.10 BREAK DOWN OF WELFARE EFFECTS - SCENARIO C-1

Millions of Dollars

PROVINCE	CONSUMER SURPLUS	PRODUCER SURPLUS	TOTAL WELFARE
Alberta			
Wheat	(168.90)	115.90	47.00
Barley	270.40	(77.13)	193.27
Canola	26.00	(14.59)	11.41
Saskatchewan			
Wheat	(176.69)	182.00	5.31
Barley	83.40	(83.40)	0.00
Canola	61.78	(44.62)	17.16
Manitoba			
Wheat	16.16	12.10	28.20
Barley	72.20	(45.90)	26.30
Canola	27.70	(6.90)	(20.80)
Total			
Wheat			
Barley	(229.37)	309.80	80.50
Canola	280.10	(211.50)	68.70
	87.80	(65.50)	22.30

TABLE VIII.11 WELFARE EFFECTS - COST SCENARIO C-2

Millions of Dollars

PROVINCE	CONSUMER SURPLUS	PRODUCER SURPLUS	TOTAL WELFARE
Alberta			
Wheat	38.30	(50.10)	(11.80)
Barley	71.72	(37.84)	33.88
Canola	15.30	(35.25)	(19.95)
Saskatchewan			
Wheat	182.10	(92.40)	89.70
Barley	62.10	(63.10)	(1.00)
Canola	33.12	(44.70)	(11.58)
Manitoba			
Wheat	129.20	(88.60)	40.60
Barley	53.60	(34.90)	18.70
Canola	25.90	(6.90)	19.00
Total			
Wheat	349.60	(231.10)	118.50
Barley	187.40	(135.90)	51.50
Canola	82.70	(65.50)	17.20

TABLE VIII.12 WELFARE EFFECTS - COST SCENARIO C-3

Millions of Dollars

PROVINCE	CONSUMER SURPLUS	PRODUCER SURPLUS	TOTAL WELFARE
Alberta			
Wheat	40.90	(50.10)	(11.80)
Barley	87.80	(54.20)	33.60
Canola	23.80	(14.65)	9.15
Saskatchewan			
Wheat	190.80	(99.20)	91.60
Barley	72.20	(71.50)	0.70
Canola	33.42	(44.60)	(11.18)
Manitoba			
Wheat	132.10	(91.10)	41.00
Barley	58.90	(38.00)	20.80
Canola	26.00	(6.90)	19.10
Total			
Wheat	364.20	(244.70)	119.60
Barley	218.90	(158.90)	60.00
Canola	83.20	(65.50)	17.70

TABLE VIII.13 WELFARE EFFECTS - COST SCENARIO C-4

Millions of Dollars

PROVINCE	CONSUMER SURPLUS	PRODUCER SURPLUS	TOTAL WELFARE
Alberta			
Wheat	17.43	(16.00)	1.43
Barley	75.40	(40.93)	34.47
Canola	24.00	(12.65)	11.35
Saskatchewan			
Wheat	106.90	(36.20)	70.70
Barley	62.60	(54.40)	8.20
Canola	33.19	(44.70)	(11.51)
Manitoba			
Wheat	105.50	(67.70)	37.90
Barley	54.90	(35.70)	19.20
Canola	26.30	(6.90)	19.40
Total			
Wheat	229.80	(119.80)	110.0
Barley	192.90	(141.80)	51.00
Canola	83.50	(65.50)	18.00

Table VIII.12 illustrates welfare gains and losses due to changes in grain pricing and freight costing. Overall, the Canadian grains sector would benefit from the new C.W.B. proposal under the Mississippi River alternative, together with a change in the method of paying freight charges. This change in producer and consumer surplus would range from a low of 171.5 million dollars (adjusted prices under cost scenario C-3) to a high of 197.3 million dollars (adjusted prices under cost scenario C-2). From the model, it is estimated that wheat producers could lose as much as 244.7 million dollars from lost production (adjusted prices under cost scenario C-1) and gain as much as 309.8 million dollars, (adjusted prices under cost scenario C-3). Given the decline in barley production, the change in producer surplus would range from -$211.5 million to -$135.9 million, that is, the livestock industry in western Canada could benefit approximately by 51 to 69 million dollars, during the simulated 1985-1986 production period. The net welfare gain to the prairie canola sector is marginal, amounting to approximately 17.2 to 22.3 million dollars.

2. Grain Flows (1985-1986)

The adjusted export quantities for wheat, barley, and canola, are used to determine the final transportation patterns of western Canadian grain. These grain transport patterns are considered in the context of actual production and marketing conditions representing west coast capacity, except in the case where approximate gains by increasing West Coast capacity to 20 million tonnes are measured.[37]

Figure VIII.2 illustrates grain flows through the St. Lawrence, Mississippi, Vancouver and/or Prince Rupert ports under adjusted prices found under cost scenario C-1. It is estimated that 73 percent of all prairie wheat could flow more cost efficient down the Mississippi River with the remaining 27 percent being diverted through West Coast ports. The origins of wheat exports through the Mississippi River were found to be located in Saskatchewan's sub-regions 14 and 568, and in Manitoba. During the simulated 1985-86 crop year and under cost scenario C-1, West Coast ports were found to be the more lucrative position for prairie barley exports. The least cost transport sub model estimates approximately a 60:40 split in transport flows of barley to Vancouver and/or Prince Rupert and through the Mississippi River system, given these adjusted applicable

---

[37] Marginal analysis and Post optimal analysis (Sensitivity Analysis) on the linear programming solution are in Appendix E.

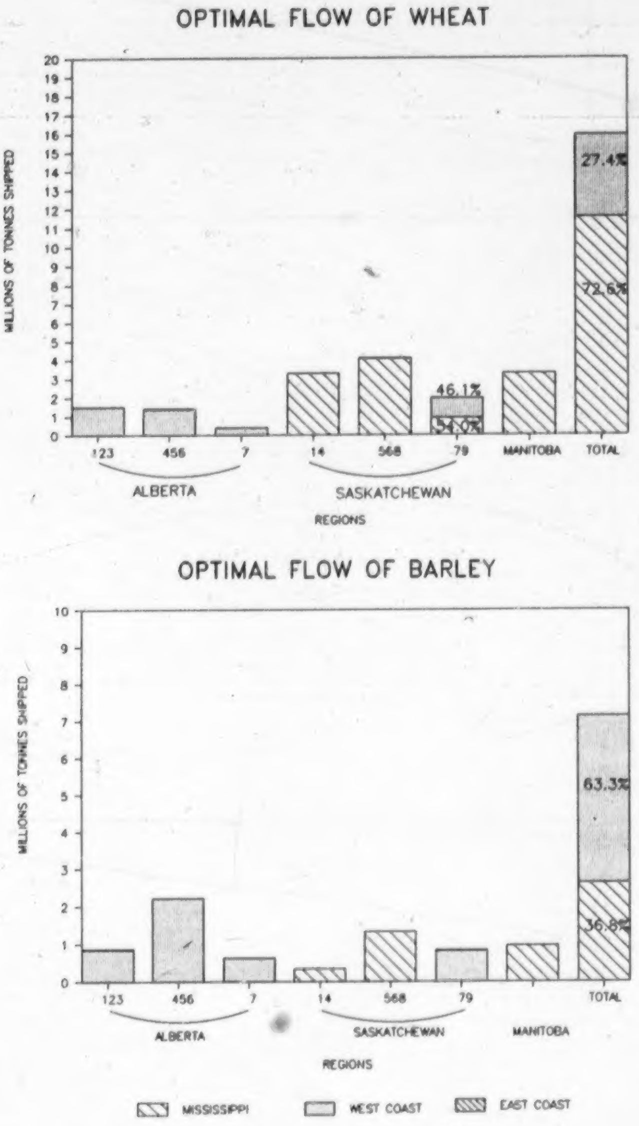


Figure VIII.2 Adjusted Grain Flows - Cost Scenario C-1

quantities. Approximately 263 thousand tonnes (93 percent) of western Canadian oats are shipped through the St. Lawrence via Thunder Bay. Wheat constitutes the bulk of grain shipments down the Mississippi River, amounting to approximately 81 percent of total tonnage. Further, total throughput at Vancouver and/or Prince Rupert ports is estimated to consist of equal quantities of wheat and barley, that is 37 percent of total grain shipments, (see Figure VIII.3). Given adjusted applicable quantities found by implementing the C.W.B. cost savings into producer prices (in cost scenario C-3 and C-4), grain trade patterns between the three export ports remain consistent with those previously discussed.

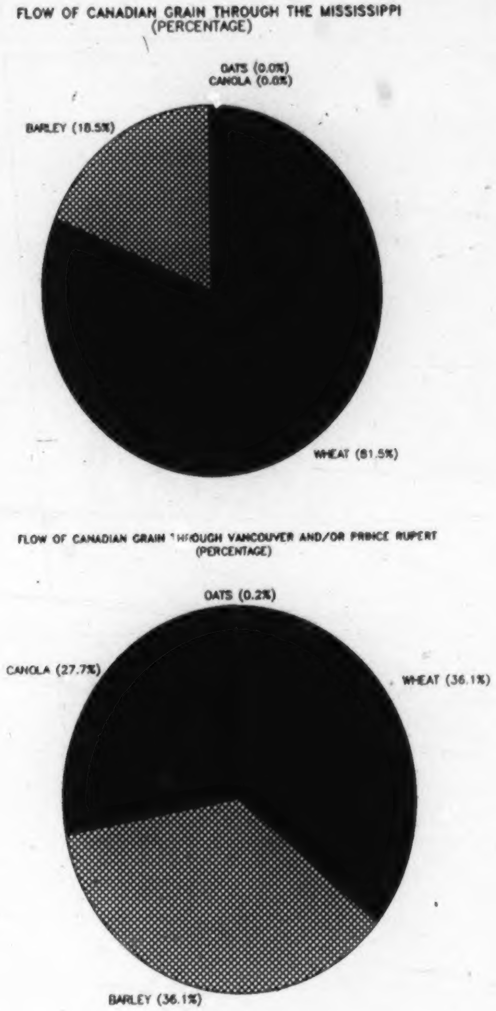


Figure VIII.3 Grain Flows Through Export Positions - C-1

Figure VIII.4 illustrates trade patterns in grain given the cost comparison C-2. Estimates from the transportation sub model indicate that if export capacity levels are increased along with a pricing change, approximately 65 percent of western Canadian wheat will flow through West Coast ports and 36 percent down the Mississippi River. The majority of export barley (62 percent) will still continue to flow through Vancouver and/or Prince Rupert. Approximately 57 percent of prairie oats will flow cost efficiently through West Coast ports with the remainder being shipped through the St. Lawrence via Thunder Bay (43 percent). By assuming cost minimization conditions and relaxing West Coast capacity, additional shipments of western Canadian grain through Vancouver and/or Prince Rupert export ports were found. Constituting these total grain tonnages handled at Vancouver and/or Prince Rupert is 44 percent wheat and barley, 13 percent canola and 0.6 percent oats. The majority of grain handlings down the Mississippi River consists of wheat (82 percent) and barley (18 percent), under the proposed C.W.B. pricing mechanism and increased West Coast capacity levels to 20 million tonnes and with the Mississippi River as a alternative grain export route, (Figure VIII.5).

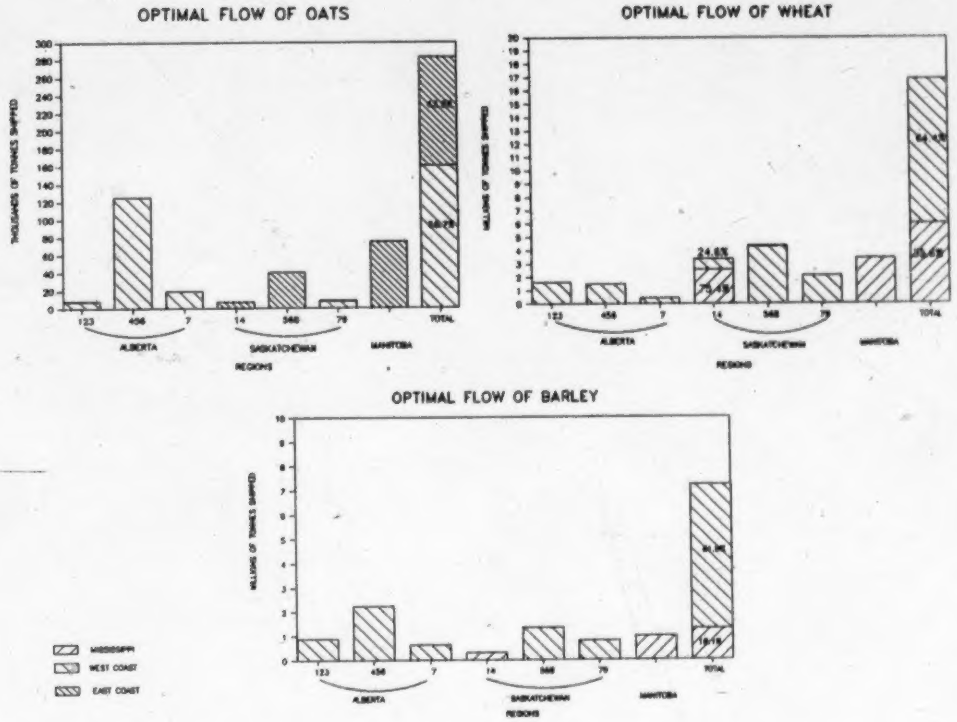


Figure VIII.4 Optimal Grain Flows - C-2

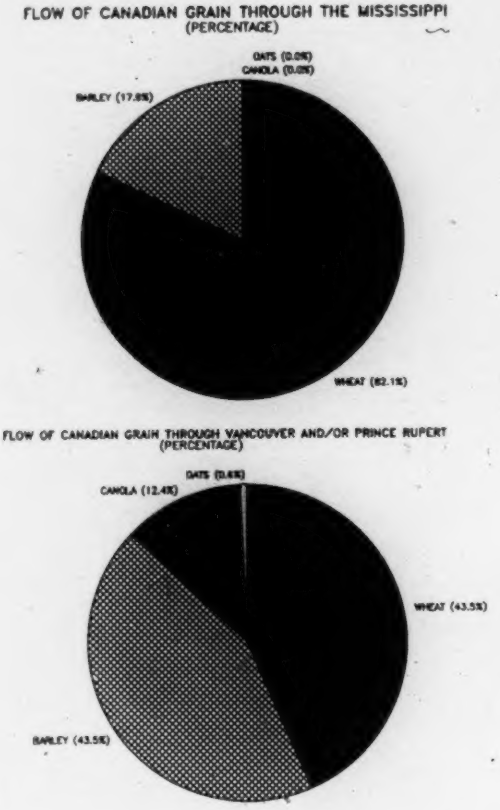


Figure VIII.5: Grain Flows Through Export Position - C-2

3. Freight Costs (1985-1986)

Total transportation costs are determined from the adjusted flows of grain through the Mississippi River, St. Lawrence, Prince Rupert and/or Vancouver ports. Table VIII.16 illustrates these final freight costs for all grains under each cost scenario on a provincial basis.

Assuming cost minimization conditions in rail transportation for western Canadian grains, freight costs to the C.W.B. would vary from a low of $2.42/tonne to a high of $8.83 per tonne for all grain. Producer costs in transporting grain, on the other hand are estimated to range from $31.86 per tonne to $31.97 per tonne. A comparison of the initial transportation costs in Tables VIII.4

through VIII.7 under each cost comparison (efficiency effect) to adjusted freight costs shows C.W.B. costs declining by approximately 50 percent for all grains. Producer costs for all grains show a substantial increase, depending upon the location of each producing area to the three export ports. The introduction of the Mississippi River as a alternative export route under the proposed C.W.B. pricing proposal show an increase in producers marketing costs but not to the magnitude as those found under St. Lawrence/Vancouver price basing points. The C.W.B. costs decline more under St. Lawrence/Vancouver price basing points than those found by introducing the Mississippi River as a viable export route for western Canadian grains. The shift of marketing costs from the C.W.B. to producers are found under each pricing scenario, which reflect the locational advantage of a producing region to Canadian export position.[38]

---

[38] Adjusted freight costs to the C.W.B. on a sub regional basis for each cost scenario are in Appendix E, Tables E - 1.

TABLE VIII.14 ADJUSTED FREIGHT COSTS

Millions of Dollars

PRODUCER COSTS

PROVINCE	WHEAT	BARLEY	CANOLA	OATS	TOTAL
C-1 SCENARIO					
Alberta	119.83	85.89	35.16	4.06	244.94
Saskatchewan	458.76	53.61	42.09	1.75	456.21
Manitoba	58.60	34.58	27.69	2.81	133.68
Total	637.19	174.08	104.94	8.62	924.83
Per Tonne	32.58	30.04	31.18	30.45	31.97
C-2 SCENARIO					
Alberta	88.99	99.62	35.16	4.06	227.83
Saskatchewan	399.46	77.23	63.46	1.75	441.90
Manitoba	33.97	39.13	26.98	2.81	202.89
Total	522.42	215.98	125.60	8.62	924.83
Per Tonne	32.76	30.25	31.16	30.45	31.97
C-3 SCENARIO					
Alberta	96.54	101.80	31.47	4.06	233.87
Saskatchewan	385.23	76.31	41.04	1.75	404.33
Manitoba	40.00	40.45	23.28	2.81	206.54
Total	521.77	218.56	95.79	8.62	844.74
Per Tonne	32.62	30.24	31.05	30.45	31.86
C-4 SCENARIO					
Alberta	89.83	103.49	30.65	4.06	228.03
Saskatchewan	298.29	80.32	40.99	1.75	421.35
Manitoba	134.64	40.88	22.42	2.81	200.75
Total	522.76	224.69	94.06	8.62	850.13
Per Tonne	32.78	30.27	31.03	30.45	31.95

...Continued

TABLE VIII.14 *Con't* ADJUSTED FREIGHT COSTS

Millions of Dollars

C.W.B. COSTS

C-1 SCENARIO					
Alberta	0.00	10.00	-	2.87	2.87
Saskatchewan	207.22	23.26	-	0.63	231.11
Manitoba	17.68	3.86	-	0.00	21.54
Total	224.90	27.12	-	3.50	255.52
Per Tonne	11.50	14.68	-	12.34	8.83
C-2 SCENARIO					
Alberta	0.00	0.00	-	2.87	2.87
Saskatchewan	154.18	31.77	-	0.63	186.58
Manitoba	14.94	4.36	-	0.00	19.30
Total	169.12	36.13	-	3.50	208.75
Per Tonne	10.61	5.06	-	12.34	8.15
C-3 SCENARIO					
Alberta	0.00	0.00	-	0.00	0.00
Saskatchewan	38.84	4.75	-	0.50	44.09
Manitoba	15.61	4.51	-	0.00	20.12
Total	54.45	9.26	-	0.50	64.21
Per Tonne	3.40	1.28	-	1.75	2.42
C-4 SCENARIO					
Alberta	0.00	0.00	-	2.87	2.87
Saskatchewan	158.42	33.10	-	0.63	192.15
Manitoba	15.01	4.56	-	0.00	19.57
Total	173.43	37.66	-	3.50	214.59
Per Tonne	10.87	5.07	-	12.34	8.06

IX. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. Summary

The current practice of price pooling all receipts from the export of grain does not adequately reflect the farm gate price of those producers supplying the West Coast. The major thrust of this research has been centered om policy issues related to price pooling by the Canadian Wheat Board. Emphasis in this study is placed on the distributional aspects of price pooling and not on the time dimension. Several scenarios were examined in order to determine impacts to production and regional welfare by changing grain prices.

An econometric sub model integrated with a production simulation, and linear transportation sub model was used to assess price pooling. The model subdivides western Canada into seven producing regions. This commodity model incorporates 21 supply responses. Supply responses for wheat, barley, and canola for each sub region were estimated. Basically, the conceptual models for these supply responses are similar. These supply functions consists of production as a function of the own farm gate price, cross price, and exogenous supply shifters. Also included in this analysis are two export ports, West Coast and Thunder Bay, as two separate demand areas. Geographical separation of the different producing and consuming regions delineates them as individual trading areas. West Coast (Vancouver and Prince Rupert) capacity constraints are also included in the transportation sub model. To more closely simulate the production and marketing conditions during each simulated crop period, actual shipment levels through the West Coast were assigned. An upper limit on West Coast capacity (20 million tonnes) was also assigned. In total, two linear programming solutions were obtained under each scenario.

Grain (wheat, barley, canola, and oats) are exchanged between each sub region and the export ports. Trade which occurs between each sub region and the two export ports is viewed as an attempt to increase producer welfare. This spatial equilibrium problem is one of measuring producer surplus subject to production and demand constraints for shipments between regions. Demand in this research represents derived demand and is assumed fixed throughout the study.

Demand in the barley market at the farm level consists of demand for on-farm feed use and export demand. Demand for on-farm feed use is primarily the feed grain requirements for livestock in a particular region. Feed grain requirements were determined by converting livestock inventories on farms as of July 1 to a standard basis known as "grain consuming units", which indicate the annual grain requirements for each class of livestock. Basically the feed grain consuming factors are multiplied by the livestock inventory numbers in a particular region to determine feed barley requirements. The level of on-farm feed barley demand is assumed to be constant throughout each time period in the simulation sub model. Stocks of barley available for export at the farm gate is basically a function of total production minus feed grain requirements. This assumes that each sub region consumes its own product and exports the remainder. Total derived demand for barley is represented by a horizontal summation of feed use and export demand. Derived demand for wheat and canola consists primarily of quantities available for export and is represented by on point, total production.

1. Canadian Wheat Board Proposal - Pay Railways

The purpose of this scenario was to analyze the effects of the Canadian Wheat Board Proposal, announced in Grain Matters in November 1985. It was proposed that all grain sold to the C.W.B. will be based on the transportation charge to Vancouver or the St. Lawrence, whichever is lowest. Currently, Seaway charges for grain shipments through the St. Lawrence seaway system via Thunder Bay are deducted from each specific pool account and shared by all grain producers in western Canada through sales pooling. Under the new proposal, producers shipping grain through the St. Lawrence seaway would not bear any additional cost of these movements but would absorb a larger proportion of total grain transportation costs. Currently, pool accounts are operated on the basis in store Thunder Bay or Vancouver and appropriate producer freight rates are deducted from initial prices. Under the new C.W.B. proposal West Coast ports would be the more logical location for the majority of western Canadian grain exports. The new proposed policy would than result in the West Coast freight rate being deducted from initial payments.

a. Cost Savings

Under the current Western Grain Transportation Act, charging all grain producers the Vancouver freight rate does not, in fact, reduce total transport marketing costs unless grain actually is moved through the West Coast ports. Also, increasing freight rates to all producers shipping to Thunder Bay by the Vancouver freight rate reduces the initial price of grain but does not reduce the additional costs incurred by the specific pool accounts. Therefore, the difference between the deducted freight rate and the actual rate would enter into pool accounts as a cost savings (revenue).

Cost comparisons were used to determine the level of cost savings. These comparisons consisted of the following:

A-1. Comparison of St. Lawrence/Vancouver pricing to Thunder Bay/Vancouver pricing with actual production and marketing conditions representing West Coast capacity.

A-2. Comparison of St. Lawrence/Vancouver pricing with a 20 million tonne constraint at West Coast ports to Thunder Bay/Vancouver pricing with actual production and marketing conditions representing West Coast capacity.

A cost comparison (scenario A-1) of St. Lawrence/Vancouver pricing to Thunder Bay/Vancouver pricing with actual production and marketing conditions at West Coast ports results in C.W.B. savings for wheat in the range of $1.02 to $1.81 per tonne. Implementing the C.W.B. proposal would also create savings to barley pool accounts by $0.60 to $1.45 per tonne.

By increasing the West Coast capacity to 20 million tonnes and implementing the C.W.B. proposal (scenario A-2), savings to board accounts results. In fact, C.W.B. savings for wheat over the simulated period would range between $5.62 to $12.47 per tonne. The Board would also experience savings over the simulated period to barley accounts in the range of $0.60 to $1.55 per tonne.

b. Policy Adjustments

c. Production

Since the C.W.B. policy is to pool prices at both St. Lawrence and Vancouver, this results in initial prices being adjusted for both wheat and barley by the amount of these cost savings. Inserting the savings found in scenario A-1, total grain production over the simulated period would vary by 26 and 35 million tonnes. This represents approximately a 1.3 to 2.06 million tonne decline in total grain production. In Alberta, it is estimated that grain production would increase, by 6.93 to 49.9 thousand tonnes for barley, 35.23 to 51.52 thousand tonnes for wheat, and 0.54 to 2.77 thousand tonnes for canola. Saskatchewan would experience a decline in barley production over baseline levels, of 2.46 to 734.7 thousand tonnes. Canola production within the province of Saskatchewan would decline marginally, by 1.16 to 36.47 thousand tonnes. Saskatchewan given a change in the price basing point from Thunder Bay to the St. Lawrence is estimated to produce more wheat, of approximately 8.29 to 27.39 thousand tonnes. The largest impact on production is found in the province of Manitoba, where, barley production would have declined by approximately 37.16 to 51.95 thousand tonnes and wheat production would decrease by as much as 18.64 to 47.21 thousand tonnes. Canola production in the province of Manitoba would increase between 0.42 and 1.09 thousand tonnes.

Grain production in western Canada under cost scenario A-2 would vary by 26 and 35 million tonnes. This represents approximately a 3.9 (1.3 million tonne) to 6 (1.7 million tonne) percent decrease over baseline grain production levels (Thunder Bay/Vancouver, with a method of payment to the railway). Alberta barley production was estimated to increase by 1.93 to 78.42 thousand tonnes over the simulated period. But, during the 1983 and 1987 crop years, barley production in Alberta would decrease by 28.99 and 28.75 thousand tonnes respectively. Major impacts to Alberta wheat production would occur during the simulated period under St. Lawrence/Vancouver pricing with cost savings estimated in scenario A-2, by approximately 125.48 to 354.02 thousand tonnes. During the same time period, canola production in Alberta would also increase, by approximately 5.74 to 29.10 thousand tonnes. In Saskatchewan, following the price adjustment of A-2 cost savings, wheat production is estimated to increase by 73.62 and 426.88 thousand tonnes. Barley and canola production in Saskatchewan, on the other hand, would decline. This decrease is estimated to be 92.19 and 775.74 thousand tonnes for barley, and 16.5

and 54.03 thousand tonnes for canola. Wheat production in Manitoba when compared to the baseline scenario, is estimated to increase by 19.38 and 104.74 thousand tonnes over the simulated period. Barley production during the same time frame is estimated to decline by 16.95 to 48.42 thousand tonnes. Canola production in Manitoba because of a price policy change and estimated cost savings under scenario A-2 would increase by 3.96 to 15.81 thousand tonnes.

d. Welfare

The new C.W.B. pricing proposal with cost savings under scenario A-1 would increase returns to Alberta wheat producers by approximately 5.85 to 8.17 million dollars. Returns to barley producers in Alberta would increase between 1.2 to 5.27 million dollars over the simulated period. Cost savings found in scenario A-2 result in an increase of approximately 19.84 to 57.67 million dollars in wheat returns within the province of Alberta. Further, under scenario A-1, net returns for wheat in Saskatchewan will increase by 16.34 to 96.30 million dollars over the simulated period and 35.16 to 165.96 million dollars under scenario A-2. Canola in Saskatchewan is estimated to increase under both cost scenarios by 0.34 to 7.76 million dollars.

Barley producers in Manitoba would experience a decline over the simulated period and under both cost scenarios, 2.8 to 5.31 million dollars under cost scenario A-1 and 1.79 and 3.6 million dollars under cost scenario A-2. Wheat returns in Manitoba under calculated savings in scenario A-1 would have decreased by 3.07 to 7.8 million dollars over the simulated period. Returns to Manitoba wheat producers is estimated to increase under savings found in scenario A-2, 3 to 17 million dollars. Canola returns to Manitoba producers would increase by approximately 0.37 million dollars and decline by approximately 6.3 million dollars under the two cost comparisons over the simulated period.

With estimated cost savings in scenario A-1, livestock producers in western Canada are estimated to incur decreases in barley feeding costs by as much as 9 million dollars (increase in consumer surplus) and increases amounting to a maximum of 1.7 million dollars (decrease in consumer surplus). Changes in consumer welfare for purchases of wheat over the simulation period are estimated to decrease by approximately 4.0 to 5.9 million dollars. But, during the 1982-83 crop year this change in consumer surplus for wheat is estimated to increase by 10.9 million dollars under adjusted prices from cost savings in scenario A-1.

Changing the grain pricing mechanism results in a net benefit to the western Canadian grains, oilseeds, and livestock economy by 0.87 to 2.2 billion dollars under cost scenario A-1. This ignores any regional impacts between provincial livestock and grain sectors.

In general, Alberta barley costs to livestock producers are expected to increase after the C.W.B implements their pricing proposal and receives savings equivalent to those in scenario A-1. These increases are estimated to be as much as 7.7 million dollars and are expected to decrease during the 1982-83 crop year by 4.7 million dollars. Therefore, over the simulated period, a net benefit of 8.4 to 170.7 million dollars would result in Alberta's barley sector.

Changes in consumer surplus for wheat are estimated to decrease by 10.8 million dollars and increase by approximately 5.7 million dollars in Alberta, over the simulated period. The net benefit in Alberta's wheat sector is estimated to be larger than the benefit estimated for the barley sector. In fact, net welfare for Alberta's wheat sector would range between 11.8 to 769.5 million dollars, after the C.W.B implements its new pricing proposal and receives cost savings in scenario A-1.

In Saskatchewan, it is estimated consumer surplus for barley would increase by approximately 0.2 to 1.8 million dollars, whereas welfare to consumers purchasing wheat would decrease by 0.48 to 6.9 million dollars, over the simulated period. This indicates a benefit to livestock producers purchasing barley in Saskatchewan. The net benefit to Saskatchewan's grain, oilseed, and livestock sectors is estimated to be 58.3 million to 1.1 billion dollars, if cost savings obtained are those under scenario A-1 from 1982 to 1987.

The greatest benefit to livestock producers was estimated to be in Manitoba, where consumer surplus for barley increased by 4.9 and 7.9 million dollars, from 1982 through 1987. Change in consumer surplus for wheat in Manitoba increased by 5.6 to 12.5 million dollars, after adjustments for cost savings in scenario A-1. The net benefit for Manitoba's grain, oilseed, and livestock sector varied between 8 and 363 million dollars.

Given the cost savings determined in cost scenario A-2 and consumer surplus changes, livestock producers in western Canada could have benefited by 1.5 to 10.8 million dollars, if the C.W.B. had implemented their pricing proposal between 1982 to 1987. On an aggregate level, consumer surplus changes indicate gains to consumers in the wheat sector by approximately 178.6 to 241.5 million dollars, over the simulated period. The grains and livestock sectors within western Canada would incur a net benefit of 192.2 million to 3.2 billion dollars after the introduction of St. Lawrence/Vancouver pricing and C.W.B. cost savings in pool accounts amounted to those in scenario A-2.

With the use of cost savings in scenario A-2, it was estimated that changes in consumer surplus would decrease in Alberta, except during the 1982-1983 crop year. Therefore, livestock producers purchasing barley in Alberta could receive a loss when compared to their existing situation. Changes in consumer surplus for barley in Alberta range from 2.9 to 14.9 million dollars, as opposed to 23.5 to 78.3 million dollars for wheat. Net welfare in Alberta is estimated to increase over the simulated period by approximately 110.89 to 994.94 million dollars. This suggests that the new C.W.B. proposal causes a transfer of wealth from consumers to producers within Alberta, when A-2 costs savings are used to adjust regional prices.

Changes in consumer surplus within the province of Saskatchewan are estimated to decrease for both wheat and barley purchases. Exceptions to this, occur for barley during the 1985-1986 crop year, and for wheat during the 1983-1984 crop year. Changes in consumer surplus for barley decrease by approximately 0.29 to 5.5 million dollars, and 49.8 to 136.2 million dollars for wheat. Therefore, under the new pricing mechanism, consumers transfer wealth to producers. Net welfare for all grains and oilseeds range from a low of $78.6 million to a high of $1 billion, over the simulated period in the province of Saskatchewan.

Consumers, ie. livestock producers, in the province of Manitoba, benefit by the introduction of a new C.W.B. pricing mechanism. This benefit ranges from 2.5 to 5.7 million dollars over the simulated period. Changes in consumer surplus within the province of Manitoba would decrease between 5.5 and 26.8 million dollars. Net welfare within the grains and livestock economy in Manitoba is estimated to be 2.69 to 439.42 million dollars. The result is that barley producers transfer wealth to consumers. Within the wheat sector in Manitoba, producers transfer wealth to consumers.

e. Grain Flows

It was found that marginal shifts in wheat flows would have been experienced if the C.W.B. had implemented its pricing proposal with current production and marketing conditions representing West coast capacity and cost savings were equivalent to A-1. These changes occur within the province of Alberta, where approximately 24 percent more wheat would be shipped via the East Coast following the price change during the 1983-1984 crop year. Also during the 1985-1986 crop year a shift of approximately 5 percent of Alberta wheat from the West Coast to the East Coast would occur under the C.W.B. proposal.

It was found that changes in barley flows (scenario A-1) would occur when compared to unadjusted transport patterns under St. Lawrence/Vancouver pricing. During the 1982-1983 crop year it was estimated that an increase in Saskatchewan's barley movements of approximately 11.5 percent would be shipped via the East Coast, if competitive conditions were maintained in the western Canadian grains economy. During the 1983-84 crop year approximately 75 percent of barley shipments from Manitoba would move through the East Coast instead of through Vancouver. It is estimated that in Alberta during the 1984-85 crop year a shift in barley transport patterns would occur, that is, 24.9 percent of total barley shipments would move through the St. Lawrence via Thunder Bay. It is also estimated that during the 1985-1986 crop year, in Manitoba, 8 percent more barley would be shipped via Thunder Bay. Comparing the results of adjusted barley flows with St. Lawrence/Vancouver pricing to transport patterns under Thunder Bay/Vancouver pricing shows in general more utilization of the West Coast Ports. In fact during the 1983-1984 crop year, approximately 24.9 percent more barley from Manitoba would have been shipped through the West Coast. Also during the 1985-1986 crop year it is estimated that 13.2 percent more barley would have been moved through Vancouver and/or Prince Rupert. An exception to these changes occurs in Alberta during the 1984-1985 crop year where approximately 24.9 percent of barley transport patterns from Alberta would have been shipped through Thunder Bay instead of through West Coast Ports.

From 1982 to 1987 approximately 11.7 to 23.5 million tonnes would have been shipped through the East Coast as opposed to 0.40 to 6.5 million tonnes through Vancouver and/or Prince Rupert under A-2 cost savings. Transport patterns for wheat under both cost scenarios (A-1 and A-2) were found to be identical. But the quantities shipped under each cost scenario from the three prairie provinces was estimated to vary.

During the simulated (1982-1987) period, it was estimated that approximately 3.4 to 8.2 million tonnes of barley would be shipped through West Coast ports given adjusted provincial exports under A-2 cost savings. During 1982 through 1984 crop years approximately 0.78 to 1.88 million tonnes would have been transported through the St. Lawrence via Thunder Bay. It was found that Thunder Bay would not be a lucrative position for barley exports during the crop years 1985 through 1987. Given estimated provincial barley exports, a shift in shipping patterns during the 1984-1985 crop year from the province of Alberta between cost scenarios A-1 and A-2 was found. This difference indicates that under A-2 savings, all barley in Alberta would be shipped through West Coast ports, where, under A-1 savings 24.9 percent was estimated to be shipped through the Eastern transport system. All remaining barley shipping patterns in Western Canada remain identical between both cost scenarios.

f. Freight Costs

It is estimated that producers would pay 163.19 to 233.78 million dollars on all grain shipments or $4.65 to $7.34 per tonne, given transport pattern with adjusted exports under scenario A-1. This represents approximately a 10 to 15 percent decrease in total producer freight costs when compared to initial freight costs under St. Lawrence/Vancouver pricing with actual production and marketing conditions representing West Coast capacity. The approximate decrease in producer transportation costs is estimated to be 18 to 41 million dollars. In comparison to Thunder Bay/Vancouver pricing, total producer costs from all grain shipments would be identical to those under St. Lawrence/Vancouver pricing with A-1 cost savings. This is reasonable since aggregate grain shipping patterns remained consistent between Thunder Bay and St. Lawrence/Vancouver pricing.

Canadian Wheat Board costs given A-1 adjusted export quantities is estimated to range between 299.66 and 497.53 million dollars over the simulated period. This represents an increase in C.W.B. shipping costs over unadjusted applicable quantities under St. Lawrence/Vancouver pricing by approximately 11 to 13 percent or 33 to 49 million dollars. As expected C.W.B. costs would remain equivalent to those found in the baseline scenario (Thunder Bay/Vancouver pricing).

It was estimated that over the simulated period the federal Government's contribution to freight costs would range from 565.13 to 802.70 million dollars. Marginal increases in the total monies allocated by the federal Government in subsidizing grain shipments would increase marginally between the initial and adjusted export quantity case. This increase would range between 3.78 and 15.32 million dollars. In comparison to Thunder Bay/Vancouver pricing to adjusted prices under the St. Lawrence proposal, Government grain shipping costs would increase by approximately 0.89 to 6.86 million dollars under cost scenario A-1.

Adjusted freight costs using A-2 cost savings, results in total logistic costs to producers from all grain shipments ranging between 154.63 and 239.23 million dollars. In comparison to Thunder Bay/Vancouver pricing, these producer costs indicate an increase of approximately 6.23 and decrease of 8.37 million dollars.

It was found that Canadian Wheat Board costs from all grain shipments under St. Lawrence/Vancouver pricing with A-2 cost savings would range between 305.50 and 514.52 million dollars over the simulated period. This represents an increase in C.W.B. shipping costs by 5.64 to 17.25 million dollars on all grain shipments when compared to the baseline scenario.

Government costs on all grain shipments is estimated to range between 578.86 to 803.70 million dollars from 1982 to 1987 (Scenario A-2). The Government's contribution towards grain shipments under Scenario A-2 would also increase, by approximately 4.57 to 36.90 million dollars. But during the 1986 crop year government shipping costs would decrease by 1.85 (Scenario A-1) and 0.85 (Scenario A-2) million dollars.

2. Method of Payment to Producers

Producer freight rates under the current W.G.T.A. do not reflect the direction of grain flows in western Canada. Consequently, additional costs are borne by the C.W.B. through pool accounts, and the federal Government. These increased costs to the C.W.B. because of this freight rate distortion are pooled amongst all western grain producers. The impact of price pooling under a different freight rate policy (producers paying full transportation charges) would reflect the direction of grain shipments and the location of a producer to the export market, while at the same time decreasing these additional costs to the C.W.B. and the Federal Government. Any changes that occur in production and shipments because of a different method of payment are therefore analyzed in this scenario.

a. Cost Savings

Costs from shipping grain from each province under different "methods of payments" and constraint levels were compared to determine savings to the Canadian Wheat Board. These savings represent revenue to grain pool accounts which is associated with a method of payment change to producers. The cost scenario consisted of:

> C.W.B. costs under a Pay the Producer Method of Payment compared to the present payment mechanism, together with actual production and marketing conditions representing West Coast capacity.

Given an aggregate reduction in barley production and a shift in flows from Vancouver and/or Prince Rupert ports to the East Coast, an increase in C.W.B. barley shipment costs results. Therefore, farm gate returns for prairie barley farmers decrease by approximately $1.04 to $10.00 per tonne over the simulation period. Wheat returns for producers, on the other hand, should increase between $18.84 to $34.87 per tonne, reflecting a decrease in prairie production.

b. Production

The savings found in the above cost scenario are then inputted into each sub regional wheat and barley supply function through prices to determine final production levels associated with a method of payment change to producers. It was estimated from 1983 through 1987 that if the federal Government had implemented a method of payment change and the C.W.B. could estimate cost savings associated with grain shipments and distribute them to producers, total grain production over baseline levels would have decreased from a low of 1.42 million tonnes (4.21 percent) to a high of 3.88 million tonnes (11.11 percent).

Changing the costing procedures to producers in reference to freight charges also creates intraprovincial impacts that are not similar to those found at the aggregate level. For example, wheat production in Alberta and Saskatchewan is estimated to increase over the simulated period, while Manitoba production would decrease, when compared to baseline production levels. The approximate magnitude of an increase in wheat production within the province of Alberta would range between 362 (7.12 percent) and 605 (17.57 percent) thousand tonnes. But during the 1985-1986 crop year, wheat production under this costing procedure would have declined by approximately 1.12 percent or 62 thousand tonnes. The direction of change in wheat production within Saskatchewan is similar to Alberta's provincial impacts. In terms of magnitude, Saskatchewan's wheat production would have increased by 4.25 to 7.99 percent or 493 to 765 thousand tonnes. Also during the 1985-1986 crop year, wheat production in Saskatchewan was estimated to decline by 2.92 percent (409 thousand tonnes). Consequently, Manitoba wheat production decreases by approximately 22 to 613 thousand tonnes. This represents a 0.68 to 16.5 percentage decline in Manitoba wheat production over the simulated period when compared to estimated wheat production levels under existing conditions.

It is estimated that barley production after policy adjustments would decrease under a method of payment change in western Canada. But, the magnitude of decline in barley production would vary between the three prairie provinces. In Alberta, barley production levels are estimated to decline over baseline levels by 11.11 to 23.82 percent or 587.42 to 887.49 thousand tonnes. Major declines in Saskatchewan barley production levels are expected to occur under the new costing procedure by approximately 0.93 to 1.24 million tonnes, representing a 30.51 to 59.58 percentage decrease. Manitoba barley production would also decrease during the simulated period, 1.79 to 2.90 million tonnes.

Canola production is estimated to increase in Alberta and Manitoba over the simulated period, following a change in the method of payment with the previous cost savings. The greatest increase is in Alberta, where canola production increased between 9 to 94 thousand tonnes. Saskatchewan would experience marginal increases in canola production (during the 1983 and 1985 crop years) following a freight costing change. But Saskatchewan's canola production is estimated to decrease by 23.63 thousand tonnes during the 1984-1985 crop year, 75.81 thousand tonnes in 1986-1987, and 17.73 thousand tonnes in the 1987-1988 crop year.

c. Welfare

After a change in the method of calculating producer transport charges with cost savings incorporated into farm gate prices, producer surplus for all grain would vary between 1.3 and 2.2 billion dollars. The result indicates a decrease in net returns to Prairie grain producers between

8.8 and 27.1 percent, if the federal Government had implemented this change in producer freight charges between 1983 and 1987. The approximate magnitude of this decline would range from a low of 210 to a high of 501 million dollars.

In Alberta, a decrease in barley returns would result from changing producer freight rates of 24.58 to 60.89 percent or 30.89 to 96.16 million dollars. Major declines in net returns are expected to occur for Saskatchewan and Manitoba barley producers. Saskatchewan producer returns from barley production is estimated to decline over the simulation period between 21 and 78 percent. In dollar terms this decline in Saskatchewan barley production would amount to 30 to 46.90 million dollars. In terms of magnitude the largest decrease in Saskatchewan barley returns would amount to 106.85 million dollars. Manitoba barley producers' returns, on the other hand, could decrease by approximately 52 to 92 percent or 38 to 92 million dollars.

In general, wheat returns in each province are expected to decrease after a method of payment change to producers. Nonetheless it was found that during the 1984-1985 and 1985-1986 crop years, these returns would increase after the transportation policy change for Alberta producers. This increase would amount to 24.4 million dollars during the 1984-1985 crop year and 52.38 million dollars in 1985-1986. Also in Saskatchewan, wheat returns are expected to increase during the 1984-1985 and 1985-1986 crop years. This increase in Saskatchewan wheat returns is expected to be 22 and 37 million dollars. The largest impact in producer welfare from wheat production after a method of payment change occurs in Manitoba, where returns are estimated to decrease between 37 and 91 million dollars.

Canola returns for each province and for each crop are estimated to decrease after a method of payment change. In Alberta the decrease in canola returns varies between 42 and 185 million dollars. In Saskatchewan the decrease would change downwards by approximately 32 and 45 million dollars. Marginal changes are expected to occur to Manitoba canola producers of 0.75 to 10.5 million dollars.

In western Canada after a method of payment change to producers, consumers would benefit by approximately 158 to 604 million dollars. This benefit occurs because of the decreasing sub regional prices. The impacts to consumers because of a change in the method of payment are estimated to be different depending upon the crop. For instance the consumer benefit after the policy change for barley purchases ranges between 205 to 334 million dollars, whereas consumers purchasing canola could benefit by approximately 60 to 93 million dollars.

In Alberta, consumers purchasing barley and/or canola would seek an increase in their welfare after a method of payment change. During the simulated period, 1983-1987, livestock producers in Alberta would experience approximately 101 to 161 million dollars. The magnitude of this for consumers purchasing canola within Alberta would range between 20 and 29 million dollars. Consumer surplus from wheat purchases in Alberta would decrease by 16 to 43 million dollars over the simulation period. But during the 1986-1987 crop year, consumer welfare increased by 25 million dollars from wheat purchases.

Saskatchewan barley consumers are estimated to experience an increase in welfare by approximately 53 to 97 million dollars over the simulated period after the change in the method of payment. Consumers purchasing canola within the province of Saskatchewan would see an increase in their welfare of approximately 23 to 37 million dollars. But consumers purchasing wheat in Saskatchewan between the crop years 1983-1984 to 1985-1986 would experience a decrease in their welfare, through higher prices, by approximately 6 to 10 million dollars. The remaining crop years involving consumer welfare from Saskatchewan wheat purchases show an increase of 82 to 153 million dollars.

Manitoba consumers purchasing wheat, barley, and canola are estimated to experience an increase in welfare, except during the 1985-1986 crop year, when consumer welfare decreased from wheat purchases. The gain to consumers, ie. livestock producers, from barley purchases, is approximately 45 to 83 million dollars. Gains from wheat and canola purchases in Manitoba are approximately 13 to 71 million dollars, and 17 to 27 million dollars, respectively.

Net welfare in western Canada because of a change in the method of payment after adjustments would range from a low of -351.74 in 1983-1984 to a high of 112.56 million dollars in 1987-1988. Distribution of welfare differs between wheat, barley, and canola on an aggregate basis. For instance the net welfare gain in the prairie barley economy is estimated to range between 53 and 138 million dollars. The canola economy would experience a welfare gain ranging from 10.5 to 23.6 million dollars over the simulated period, following a method of payment change. It is estimated that if the federal Government had implemented a method of payment change in western Canada, the wheat economy would have experienced a net loss in welfare of 7 to 122 million dollars.

Intra provincial impacts in reference to net welfare are diverse given changes in producer freight rate costing. In Alberta the barley economy was found to gain approximately 57 to 86 million dollars, that is, the loss in producer surplus is less than the gain in consumer surplus over the simulated period. Also, the canola economy in Alberta would experience a gain of approximately 5 to 11.8 million dollars during the same time frame. The wheat economy within the province of Alberta is estimated to experience a decrease in net welfare, 20 to 147 million dollars. However during the 1986-1987 crop year the wheat economy in Alberta would have an increase in net welfare of approximately 9 million dollars.

The Saskatchewan barley economy because of changes in the method of payment would experience gains of approximately 12.3 to 51.96 million dollars and losses of 10 to 20 million dollars. The canola economy in Saskatchewan is estimated to have net welfare losses during each crop year in the simulated model of 3 to 11 million dollars. In the Saskatchewan wheat economy net welfare gains would have been experienced during the 1983 and 1987 crop years of 15.3 and 3.95 million dollars. But during the 1983 and 1985 crop years there would have been a net loss to Saskatchewan's wheat economy of 68.19 to 276.03 million dollars.

In Manitoba over the simulated period, it is estimated that the wheat and canola economy would have experienced a net welfare gain. This gain in barley ranges from 17 to 31 million dollars and 9 to 20 million dollars in the canola economy. The wheat economy is estimated to experience net welfare losses in Manitoba of 9 to 77 million dollars, after a method of payment change.

d. Grain Flows

Over the simulated period, it was estimated that 3.4 to 8.8 million tonnes of wheat would be transported through Vancouver and/or Prince Rupert. On the other hand, it would be more cost efficient if approximately 4.3 to 17.6 million tonnes were allocated to East Coast ports. Export restrictions at the West Coast became binding during the 1984 and 1985 crop years. This constraint caused 2.1 million tonnes in 1984 and 605 thousand tonnes in 1985 of wheat, from Alberta, to be shipped through Thunder Bay. The West Coast tended to be the more lucrative position for wheat shipments from the provinces of Saskatchewan and Manitoba over the simulated period. An exception occurred during the 1986 and 1987 crop years in Saskatchewan, where 6.9 and 10.4 million tonnes respectively were transported through the eastern transport system.

During the simulated period (1983-1987) the majority of barley exports in western Canada were shipped via Prince Rupert and/or Vancouver, 2.6 to 5.3 million tonnes. But 1.4 million tonnes of barley during the 1983 crop year and 2.8 million tonnes during the 1984 crop year were exported through Thunder Bay. Barley shipment levels through the East Coast during the 1983 and 1984 crop years were exported from both Saskatchewan (645 thousand tonnes and 1.9 million tonnes respectively) and Manitoba (706 thousand tonnes and 937 thousand tonnes respectively).

e. Freight Costs

It was found that if the federal Government had implemented a method of payment change to producers during the simulated period, producer transport costs from all grain shipments would have increased to 679.28 and 879.85 million dollars. This represents a $12.01 to $22.32 per tonne increase in wheat shipping costs and a $15.76 to $24.37 per tonne increase in barley freight costs. The C.W.B., annually would pay 253.03 to 543.29 million dollars under a producer method of payment on all grain shipments. The Board would have also experienced a decrease in wheat shipping costs over the simulation period by $1.42 to $5.18 per tonne when compared to Thunder Bay/Vancouver pricing with a method of payment to the railway. During the 1984 crop year, with a 10 million tonne constraint at West Coast ports, an increase in wheat freight costs to the C.W.B. results, by approximately $2.17 per tonne. Barley shipping costs to the C.W.B. would increase during each year of the simulation model by $0.16 to $6.69 per tonne. Under a method of payment to producers, the C.W.B. is estimated to incur costs on Saskatchewan wheat shipments of approximately 174 to 345 million dollars, from 1983 to 1987. Also the C.W.B would incur costs of 61.62 to 89.77 million dollars on Manitoba barley shipments.

3. C.W.B. Proposal with Total Costing

a. Cost Savings

Cost savings to the C.W.B. are determined by comparing Board shipping costs under Thunder Bay/Vancouver pricing to St. Lawrence/Vancouver pricing, with the pay the producer method of payment while actual marketing and production conditions represent West Coast capacity. This cost comparison analyzed the benefits that could have been obtained by introducing the new C.W.B. proposal under a method of payment to producers.

The results indicate a cost savings to the C.W.B. from all grain shipments between $5.80 to $8.29 per tonne. In terms of Board savings on specific crops, wheat is estimated at $7.68 to $11.29 per tonne, with an associated savings in barley ranging from $2.95 to $4.34 per tonne.

b. Production

Given the cost savings determined previously, adjusted production is derived from the sub regional supply functions. It was found that wheat output in western Canada would have varied between 15.46 and 22.17 million tonnes if the C.W.B. proposal had been implemented under a method of payment change to producers. This represents approximately a 4.89 (1.14 million tonnes) to 7.76 (1.3 million tonnes) percent decline in wheat production when compared to production levels in the baseline analysis (Thunder Bay/Vancouver pricing under a method of payment to railways). The largest impact, in comparison to baseline production levels, would occur in Manitoba, where wheat production is estimated to decrease by 492.03 (15.04 percent) to 624.26 (19.51 percent) thousand tonnes. Saskatchewan wheat production would also decrease over the simulation period. The approximate magnitude of this decrease ranges from 242.14 (2.53 percent) to 367.33 (2.62 percent) thousand tonnes. Alberta wheat production when compared to baseline results decreases by 98.37 (2.86 percent) to 573.39 (9.61 percent) thousand tonnes from 1983 to 1987.

Barley production in western Canada under the new C.W.B. proposal with a method of payment change to producers is estimated to vary between 5.37 to 9.19 million tonnes. In comparison to the baseline, barley production is estimated to decrease between 1.71 (15.67 percent) to 1.82 (25.31 percent) million tonnes over the simulation period. Major regional impacts are estimated to occur in barley production when compared to estimated baseline levels. In Alberta, barley production would decrease by approximately 591.35 (15.87 percent) thousand tonnes to 1.07 (18.03 percent) million tonnes, given a method of payment change to producers under St. Lawrence/Vancouver pricing. The decrease in Saskatchewan barley production is estimated to decrease between 665.17 (20.28 percent) to 681.33 (32.79 percent) thousand tonnes. Manitoba barley production is estimated to decrease by 428.25 (20 percent) to 540.86 (39 percent) thousand tonnes from 1983 to 1987.

On a provincial basis, canola production in western Canada would vary between 2.18 and 3.26 million tonnes following adjustments because of the price and transportation policy change. This represents a marginal decrease in canola production in western Canada in comparison to baseline production levels, of 0.06 million tonnes. In Alberta, canola production was estimated over the simulation period to decrease by 20.11 thousand tonnes and increase by as much as 150.74 thousand tonnes. Marginal impacts to Saskatchewan and Manitoba canola production is estimated to occur when compared to baseline simulation results. In Saskatchewan, canola production would decrease by 6.45 thousand tonnes and increase by 10.87 thousand tonnes over the simulation period. Manitoba canola production is estimated to decrease by 17.3 to 17.9 thousand tonnes, or by 3.11 to 4.4 percent.

c. Welfare

It was estimated, over the simulation period, that producer surplus would vary between 1.09 and 2.29 billion dollars in western Canada. With a change in the method of payment under St. Lawrence/Vancouver pricing with cost savings, producer welfare when compared to baseline producer surplus would decrease by 410 thousand dollars to 1.41 billion dollars over the simulation period. Regional impacts, however, differ between the three prairie provinces because of a price and transportation policy change.

In Alberta, returns to wheat producers given adjusted production levels would decrease by 37.92 to 64.32 million dollars from 1984 to 1987. In comparison to baseline producer welfare levels, wheat producers located in Alberta would experience an increase in net returns during the 1983-1984 crop year. Associated with the large decreases in barley production in Alberta are major decreases in farmers welfare when compared to the baseline analysis. These decreases range from a low of 43.25 to 64.75 million dollars over the simulation period. This indicates benefits to livestock feeding within the province of Alberta. Canola returns in Alberta would also decrease after adjustments to production, when compared to baseline simulation results. The approximate magnitude of this decrease varies between 13.52 to 54.46 million dollars from 1983 to 1987.

In Saskatchewan, given a comparison to baseline producer welfare measures, farmers returns would decrease during the 1984-1985, 1985-1986 and 1987-1988 crop years by 49.52 to 108.49 million dollars. In 1983-1984 wheat returns for producers located in Saskatchewan would increase by 36.20 million dollars. Also during the 1986-1987 crop year Saskatchewan wheat returns would shift upwards by 51.08 million dollars. Barley returns within the province of Saskatchewan are estimated to decrease over the simulation when compared to estimated levels in the baseline scenario. These decreases range from a low of 41.18 to a high of 91.72 million dollars. Saskatchewan canola returns would also decrease during the simulation when compared to baseline levels, 29.58 to 44.69 million dollars.

Wheat returns when compared to baseline estimated levels are expected to decrease by 71.92 to 90.99 million dollars in Manitoba. Barley returns are also estimated to decrease in Manitoba over the simulated period, thus creating a benefit to livestock producers located in that province. The approximate magnitude of this decline ranges from 20.63 to 40.46 million dollars. Marginal decreases in Manitoba canola returns of 756.17 thousand dollars to 10.53 million dollars are estimated to occur during the simulated period.

It is estimated that consumers would benefit by approximately 441.71 to 783.34 million dollars from all grain purchases given the proposed changes in transportation and pricing policy. Consumers, i.e. livestock producers or foreign consumers, are estimated to benefit approximately 160.78 to 249.67 million dollars from barley purchases in western Canada. The benefit to wheat consumers in the prairies was estimated to be approximately 215.52 to 400 million dollars over the simulated period. Foreign consumers could benefit approximately 61.17 to 91.38 million dollars from purchases of canola in western Canada.

The largest impact to consumers of barley is estimated to occur in Alberta, where consumer surplus changed by 65.62 to 124.12 million dollars over the simulated period. In Saskatchewan the increase in consumer surplus for barley purchases was estimated to be approximately 43.98 to 81.25 million dollars. Manitoba barley consumers are estimated to occur a benefit ranging from 47.11 to 62.89 million dollars over the simulated period.

Relative to wheat and barley, consumers purchasing canola in the three prairie provinces are estimated to incur marginal changes. In Alberta, consumer surplus would increase by 20.4 to 28 million dollars over the simulated period. Saskatchewan canola consumers would see a benefit from purchases of 22.8 to 37.5 million dollars. Also, in Manitoba, this benefit would range from 17.94 to 26.38 million dollars.

Net welfare for the prairie region is estimated to be approximately 112.31 to 298.13 million dollars over the simulated period. This indicates a transfer of wealth from producers to consumers during the 1983 to 1987 crop years. In the Alberta barley economy, a decrease in net welfare amounting to 26.65 million dollars and a benefit of approximately 59.37 million dollars would occur during the same time frame. In the Alberta wheat economy, net welfare could range from a low of -18.51 to a high of 83.48 million dollars. The Alberta canola sector would experience a net welfare ranging from 5.15 to 10.90 million dollars. Regional net welfare effects in Saskatchewan for barley are estimated to range from a low of -43.77 to a high of 25.19 million dollars over the simulated period. The wheat economy in Saskatchewan is estimated to incur a net benefit of 48.24 to 204.93 million dollars. Canola in Saskatchewan is estimated from 1983 to 1987 to have a negative regional welfare change of 3.1 to 10.6 million dollars. In Manitoba, a net welfare is expected to occur for each grain over the simulated period. In fact, barley regional welfare would range from 10.06 to 22.42 million dollars. Net regional welfare to the wheat sector in Saskatchewan is estimated to be 6 to 6.3 million dollars. Regional welfare to the Manitoba canola sector would range from 8.05 to 20.28 million dollars from 1983 to 1987.

d. Grain Flows

It is estimated that approximately 8 to 17 million tonnes of wheat would flow more cost efficiently through the East Coast, as opposed to 2 to 8 million tonnes through the West Coast over the simulation period. The optimal transport route for adjusted wheat shipments from

Alberta was estimated to be through Vancouver and/or Prince Rupert over the simulation period. An exception to these transport patterns occurred during the 1984 and 1985 crop years. In the 1984-1985 crop year approximately 1.84 million tonnes of wheat from Alberta was transported via the eastern route, given competitive conditions in the western Canadian grains sector. Also, during the 1985-1986 crop year wheat shipments from Alberta through the St. Lawrence via Thunder Bay was estimated at 410 thousand tonnes. In other words, the tonnage constraint at West Coast ports became binding during 1984 and 1985. In Saskatchewan, the East Coast was estimated to be the more lucrative positions for wheat from 1983 to 1985,approximately 9.3 to 10.1 million tonnes. During the 1986 and 1987 crop years, 5.9 to 10.7 million tonnes of wheat from Saskatchewan, under competitive conditions, was estimated to be transported through Vancouver and/or Prince Rupert. All Manitoba wheat shipments would be transported to the eastern Canadian ports if the C.W.B.'s objective was to minimize transport costs.

The West Coast ports tend to be the more lucrative positions for barley exports in western Canada, following changes to the C.W.B. Act that led to the use of the St. Lawrence as a price basing point in the method of calculating producer freight costs. Over the simulation period, it was estimated that 3.8 to 6.8 million tonnes of barley would be transported through the West Coast, if the C.W.B. implemented its pricing proposal under a method of payment to producers and cost savings were identical to those in scenario B-2. Approximately 1.6 to 3.4 million tonnes of barley in western Canada would be transported to the eastern port. The source for barley shipments at Thunder Bay over the simulation period is estimated to flow from Saskatchewan and Manitoba. Approximately 2.4 million tonnes of barley shipments at Thunder Bay were from Saskatchewan, whereas, 1.8 million tonnes came from Manitoba.

e. Freight Costs

It is estimated that producers would incur transport costs from all grain shipments ranging between 621.71 and 892.05 million dollars. On average, producers would pay $20.75 to $29.12 per tonne to ship wheat and $23.09 to $30.77 per tonne to transport barley to export position over the simulated period.

The C.W.B. shipment costs for all grains from 1983 to 1987 was estimated to range between 258.60 to 499.85 million dollars. On a per tonne basis, the C.W.B. would incur on average a $12.34 to $23.33 per tonne freight charge from wheat shipments and $0.47 to $7.40 per tonne on barley shipments. The majority of total transportation costs to the C.W.B. occurs from Saskatchewan wheat shipments by approximately 148 to 331.73 million dollars. Also the C.W.B. would pay transportation costs for Manitoba barley amounting to 1.51 to 26.28 million dollars.

A comparison of shipping costs from the baseline analysis to adjusted freight costs found under St. Lawrence/Vancouver pricing under a method of payment to producers, results in producer freight costs increasing for all grains by 440.21 to 704.1 million dollars. It is estimated over the simulated period that producers would incur a $13.55 to $17.66 per tonne increase in transportation charges for wheat shipments. Barley transportation charges to producers were also estimated to increase over the simulated period, $17.56 to $17.93 per tonne. These producer freight charge increases are a direct result of changing the price basing point from Thunder Bay to the St. Lawrence and shifting the method of payment from the railway to producers.

In most years the C.W.B. would experience a decrease in transportation charges from grain shipments by implementing its pricing proposal while the federal Government changed the method of payment from railways to producers in western Canada. This decrease ranges from 43.47 to 89.23 million dollars. With the binding constraint at West Coast ports during the 1984-1985 crop year the C.W.B. would incur an increase in shipment costs amounting to 2.6 million dollars. On a per tonne basis, wheat shipping costs to the C.W.B. are estimated to decrease by $1.26 to $6.29. During the 1984-1985 crop year, C.W.B. wheat shipping costs are expected to increase by $0.57 per tonne. It is estimated that a variation in barley shipping costs to the C.W.B. would occur when compared to baseline levels. For instance, C.W.B. costs from barley shipments would increase during the 1983 and 1985 crop years by $6.14 and $0.02 per tonne and decrease by $10.03 per tonne in 1984, $0.08 per tonne in 1986, and $0.30 per tonne in 1987. In most crop years, implementing the C.W.B. proposal under a change in the method of calculating freight charges causes a shift in marketing costs away from the C.W.B. to producers, thereby, recognizing locational advantage to those farmers located closest to the lower cost West Coast ports.

4. Mississippi River Alternative

The institutional arrangements (government policies related to rail subsidies and port facility infrastructure) in the grain sector have traditionally led to maximizing grain exports through these Canadian ports. Major changes in government transportation policies have taken place, modifying this environment. Among these changes was the passage of the Western Grain Transportation Act in 1983. This increase in grain transportation rates set under the W.G.T.A. led to interest in the Mississippi River system as a viable alternative export route.

a. Cost Savings

The efficiency effects by introducing the new C.W.B. proposal, a method of payment change, and the Mississippi River alternative are analyzed in this scenario. These effects are in terms of cost savings through transport shipment pattern comparisons. These cost comparisons consist of the following scenarios:

> C-1 St. Lawrence/Vancouver/Mississippi pricing to Thunder Bay/Vancouver/Mississippi pricing with producers paying the full cost to ship their grain, while actual production and marketing conditions represent West Coast capacity.
>
> C-2 St. Lawrence/Vancouver/Mississippi pricing under estimated West Coast capacity by the C.W.B. to Thunder Bay/Vancouver/Mississippi pricing, under actual production and marketing levels representing West Coast capacity.
>
> C-3 St. Lawrence/Vancouver/Mississippi pricing to Thunder Bay/Vancouver pricing, all under pay the producer method of payment with actual production and marketing levels representing West Coast capacity.
>
> C-4 St. Lawrence/Vancouver/Mississippi pricing under pay the producer method of payment, to Thunder Bay/Vancouver pricing, with pay the railway method of paying freight rates, all under actual marketing and production conditions representing West Coast capacity.

These cost comparisons show total cost savings to the C.W.B. for wheat between $7.79/tonne (under scenario C-1) and $40/tonne (under scenario C-4). The Canadian Wheat Board is expected to experience an increase in barley shipment costs under scenario C-4 of $3.32/tonne and an increase of $4.91 to $8.65/tonne given the remaining comparisons. The model estimates a savings to the C.W.B. for oats shipments between $5.90/tonne (scenario C-1) and $27.96/tonne (scenario C-4). The C.W.B. on average saves between $6.05/tonne and $23.73/tonne on all grain shipments given the four cost comparison scenarios.

b. Production

Adjusted production reflects the efficiency effects determined by comparing changes in pricing grain, and methods of paying freight charges. Spring wheat, given estimates from the grain re-distribution model, would range from a low of 16 million tonnes to a high of 20 million tonnes, while barley production would vary between 8 and 9 million tonnes. Canola production, given the policy changes, would vary around 3 and 3.3 million tonnes. It is estimated that western Canadian grain production because of changes to grain pricing and freight costing would range between a level of 28.1 to 30.7 million tonnes. A comparison of adjusted production results to initial levels under the Mississippi proposal show grain production increasing by 4.5 to 14 percent because of the implementation of the new C.W.B. proposal plus a change in the freight costing mechanism, all under the Mississippi River alternative. Most of this increase occurs in wheat production which amounts to 6.7 to a 33 percent increase. Barley production, on the other hand, could decline by as much as 9 percent and increase by approximately 2 percent. Canola production would increase between 0.4 to 11 percent. These approximate magnitudes suggest that grain producers have a tendency to shift plantings away from the lower value, bulky crop, barley, to the higher value, less bulky crops of wheat and canola.

c. Grain Flows

It is estimated that 73 percent of all prairie wheat could flow more cost efficiently down the Mississippi River with the remaining 27 percent being diverted through West Coast ports under cost scenario C-1. The origins of wheat exports through the Mississippi River were found to be located eastern Saskatchewan and in Manitoba. During the simulated 1985-1986 crop year and under cost scenario C-1, West Coast ports were found to be the more lucrative position for prairie barley exports. The transportation sub model estimates approximately a 60:40 split in transport flows of barley to Vancouver and/or Prince Rupert and through the Mississippi River system, given adjusted export quantities. Approximately 263 thousand tonnes (93 percent) of western Canadian oats are shipped through the St. Lawrence via Thunder Bay. Wheat constitutes the bulk of grain shipments down the Mississippi River, approximately 81 percent of total tonnage. Further, total throughput at Vancouver and/or Prince Rupert ports is estimated to consist of equal quantities of wheat and barley, that is 37 percent of total grain shipments.

Given export quantities found by implementing the C.W.B. cost savings into producer prices (in cost scenario C-3 and C-4), grain trade patterns between the three export ports remain consistent to those grain movements previously discussed.

Estimates from the grain re-distribution model indicate that if export capacity levels are increased along with a pricing change, approximately 65 percent of western Canadian wheat will flow through West Coast ports and 36 percent down the Mississippi River, under cost scenario C-2. The majority of export barley (62 percent) will still continue to flow through Vancouver and/or Prince Rupert. Approximately 57 percent of prairie oats will flow cost efficiently through West Coast ports with the remainder being shipped through the St. Lawrence via Thunder Bay (43 percent). By assuming cost minimization conditions and relaxing West Coast capacity, additional shipments of western Canadian grain through Vancouver and/or Prince Rupert export ports were found. Constituting the total grain tonnages handled at Vancouver and/or Prince Rupert is 44 percent wheat and barley, 13 percent canola and 0.6 percent oats. The majority of grain handlings down the Mississippi River consists of wheat (82 percent) and barley (18 percent), under the proposed C.W.B. pricing mechanism and a 20 million tonne constraint at West Coast ports with the Mississippi River as a alternative grain export route.

d. Freight Costs

Assuming cost minimization conditions in rail transportation for western Canadian grains, freight costs to the C.W.B. would vary from a low of $2.42/tonne to a high of $8.83 per tonne for all grain. Producer costs in transporting grain, on the other hand are estimated to range from $31.86 per tonne to $31.97 per tonne. A comparison of the initial transportation costs under each cost comparison (efficiency effect) to adjusted freight costs shows C.W.B. costs declining by approximately 50 percent for all grains. Producer costs for all grains show a substantial increase, depending upon the location of each producing area to the three export ports. The introduction of the Mississippi River as a alternative export route, under the proposed C.W.B. pricing proposal, shows an increase in producers' marketing costs but not to the magnitude as those found under St. Lawrence/Vancouver pricing. The C.W.B. costs decline more under St. Lawrence/Vancouver pricing than those found by introducing the Mississippi River as a viable export route for western Canadian grains. The shift of marketing costs from the C.W.B. to producers is found under each pricing scenario, thereby reflecting locational advantage of each producing region to export location.

B. Conclusions

Depending upon marketing and production conditions in any one crop year, an advantage to the western Canadian grains economy could occur if C.W.B. pool accounts were able to reflect the level of savings given the different price policies. Provincial impacts under the different price and transportation policies tend to vary.

It was found that changes in wheat and barley production would occur because of a change in freight costing and grain pricing. Overall, producers would tend to shift their plantings away from the more bulky and lower value crop, barley, to the less bulky, higher value crops, of wheat and canola. Decreases in Manitoba's barley and wheat production would occur over the simulated period under each scenario. Also barley production in Alberta and Saskatchewan would decrease under a method of payment change to producers but would only increase in Alberta under St. Lawrence/Vancouver pricing following adjustments.

Larger decreases in producer welfare were found under a method of payment change to grain producers than under the remaining price scenarios. The bulk of this decrease was found to occur to barley producers. But the losses to farmers from grain production are less than the consumer increases, thereby creating a benefit to the grains and livestock sectors in Alberta and Manitoba. In Saskatchewan under a method of payment change a net welfare loss to society would result, that is, consumer increases are less than producer decreases.

Under St. Lawrence/Vancouver pricing, consumers of barley located in Manitoba would experience the largest benefit in the prairies. But, under a method of payment change to producers, livestock farmers located in Alberta experience the largest benefit. Under St. Lawrence/Vancouver pricing, barley production decreased in Manitoba, and increased in Alberta. Under a method of payment change, barley production in Alberta and Manitoba both decreased.

Modest changes in transport patterns between the scenarios were estimated to exist when West Coast capacity was restricted to current marketing conditions. The West Coast ports become the more logical position for grain when West Coast capacity is increased to 20 million tonnes. Under the Mississippi River alternative the majority of wheat shipments would travel down the Mississippi River, while the more lucrative position for barley would be West Coast ports. Canadian Wheat Board costs for grain shipments are estimated to decrease by approximately 50 percent by the use of the Mississippi River. On a per tonne basis these cost savings are, approximately, $7.79 to $40.67 per tonne for wheat. Barley pool accounts would increase by $3.32/tonne and could decrease by as much as $8.65/tonne.

In most cases, changing grain pricing and freight costing policies enables marketing costs to be reduced, and also provides recognition of the locational advantage of producers located closest to export ports, thereby restructuring regional prices of grain to partially reflect the transport costs to export ports. Lastly, inadequate facilities at West Coast ports may result in shipping grain via Thunder Bay, therefore, potentially increasing C.W.B. marketing costs. This West Coast constraint becomes a system cost, and if binding, will become costly to western Canadian grain producers.

C. Recommendations

This research utilized static spatial equilibrium theory in the context of excess supply with regional fixed demands. Implicitly, it was assumed that the demand price would change in exact proportion to supply price following policy changes. The use of a spatial equilibrium model that incorporates livestock elasticities may provide significantly different results to consumer surplus from grain price changes.

Estimated changes in crop production only occurred between wheat, barley, and canola. No allowance was made for diversification to other crops. The introduction of forage and/or special crops may provide lower estimates on changes in total producer surplus for all crops.

The linear transportation sub model used in this study ignores the proximity of major importing countries. Implicitly it is assumed that prices at the St. Lawrence and Vancouver ports are equivalent. Directions of transport flows may be different if an international grain trade model was used, thereby, causing C.W.B. cost savings to change under each scenario.

Rationalization of the grain transportation system was not considered in this research. Specific efficiency gains related to transportation rationalization were not reflected in producer freight rates. Considering such efficiency gains may reduce the estimated increase in producer's shipping costs, thereby reducing the change in production under each scenario. A further extension would be to analyze changes to grain transportation costs because of changing freight and price policies in the western Canadian grains sector.

The time dimension of price pooling was not dealt with in this research. This model could be further extended so that solutions obtained could contain time dimensions. The simplest type of model of this nature, as stated by Takayama and Judge, would be to consider n time periods instead of n regions. Further, transportation costs would be replaced by storage costs and carrying charges between time periods. Flows of commodities would reflect time periods instead of locations. The final output would be a determination of competitive demands, supplies, prices, and flows of commodities over time. A more complex model would be to add time and space simultaneously. A test of the results from this research to those obtained under different types of spatial models may be important to determine an appropriate method in solving spatial problems within the Canadian grains system. If no significant differences exist then the simpler approach will provide adequate results in policy analysis.

BIBLIOGRAPHY

Abbott, Phillip C. "Modelling International Grain Trade With Government Controlled Markets." *American Journal of Agricultural Economics*. 61(February 1979):22-31.

Agriculture Canada. *Aggregate Farm Income Impact of Alternative Methods of Crow Benefit Payment*. A paper prepared for the committee of inquiry on crow benefit payment. Regional Development Branch, Agriculture Canada, Februrary 1985.

Agriculture Canada. Market Commentary. Agriculture Canada, Market Outlook and Analysis Division, Policy Branch. December 1986.

Agriculture Canada. *Production and Marketing Responses to Alternative Methods of Payment*. Working Paper 7/85. Agriculture Canada, Food Markets Analysis Division, Marketing and Economics Branch, November 1984.

Anderson, M.S. and W.H.C. Hendricks. "*A Review of the Crow Rate Implications.*" A Report Prepared for Alberta Agriculture. August 10 1977.

Arnade, Carlos A., and Cecil W. Davison. "Export Demand for U.S. Wheat". Selected paper presented at American Agricultural Economics Association meetings. unpublished paper. Reno, Nevada, July 29 1986.

Bailey, Kenneth W. *A Structural Econometric Model of the Canadian Wheat Sector*. Economic Research Service, U.S. Department of Agriculture. Washington 1987. Technical Bulletin No. 1733.

Baker, C.B. *Interpretation of Regional and Spatial Models, Agricultural Supply Functions.* Earl O. Heady (ed.). Ames: Iowa State University Press, 1961, pp. 231-52.

Baldwin, Ray L. "*The Distribution of the Grain Handling and Transportation Costs of Prairie Farmers From 1977/78 to 1995/96.*" A Report to the Committe of Inquiry on the Crow Benefit Payment." Canadian Transport Commission, Research Branch, Ottawa, February 1985.

Barichello, Richard R. "Government Policies in Support of Canadian Agriculture and Their Costs". *Department of Agricultural Economics, University of British Columbia*, 1983. Vancouver, British Columbia. Discussion Paper #83-04.

Bawden, Lee D. "A Spatial Price Equilibrium Model of International Trade." Journal of Farm Economics. 48(4):862-874. 1966.

Bawden, Lee D. "An Evaluation of Alternative Spatial Models." *Journal of Farm Economics*. 46(5):1372-79. 1964.

Binkley, James K., and Bruce Harrer. "Major Determinants of Ocean Freight Rates for Grains: An Econometric Analysis." *American Journal of Agricultural Economics*. 63(February 1981):47-57.

Bjarnasan, Harold. "A Canadian Perspective of Grain Export Problems and Marketing." In *Agricultural Export Issues in the Post Seventies.* James R. Jones and Neil L. Meyer., (eds.). University of Idaho, College of Agriculture, Cooperative Extension Service, Moscow, Idaho, 1986. Bulletin No. 648.

Bressler, Raymond G., and J.R. King. *Markets, Prices and Interregional Trade*. John Wiley and Sons Inc., New York, 1970.

Buchholz, H.E. "Pricing and Allocation Models Applied to Problems of Interregional Trade and Location of Industries." In *Studies in Economic Planning Over Space and Time* - Contributions to Economic Analysis. George G. Judge, (eds.). North-Holland/American Elsevier, 1973.

Burt, Oscar R., and Virginia E. Worthington. "Wheat Acreage Supply Respone in the United States." *Western Journal of Agricultural Economics*. 13,1(July 1988):100-111.

Canada Grains Council. *Government Policies Supporting Grain Production and Marketing: Canada and the United States*. Canada Grains Council, Winnipeg, 1986.

Canada Grains Council. *The Structure of the Feed Grain Market in Western Canada*. Winnipeg, March 1985.

Canadian Freight Association. *Tariff CFAW 4310*, Various Issues 1982-1986. Winnipeg.

Canadian Grains Council. *Canadian Grains Industry Statistical Handbook*, Winnipeg, 1986.

Canadian Grains Institute. *Grains and Oilseeds, Handling, Marketing, Processing.* Winnipeg, 1975.

Canadian Transport Commission. *The Mississippi River Waterway: An Alternative Route for Canadian Grain Exports? An Overview of the Mississippi River Transportation System*. February 1987. Winnipeg.

Canadian Wheat Board. "*New Procedure foe Initial Payment Freight Deductions.*" *Grain Matters*. Winnipeg, November/December 1985.

Canadian Wheat Board. "Price Pooling - Sharing the Ups and Downs." *Grain Matters*. July 1984. Winnipeg, Manitoba.

Canadian Wheat Board. "The Wheat Boards Speech on Pooling to WCWGA." *Grain Matters*. Jan./Feb. 1987. Winnipeg, Manitoba.

Canadian Wheat Board. "The Workings of Canada's Two-Price Wheat System." *Grain Matters*. June 1977. Winnipeg, Manitoba.

Canadian Wheat Board. *Annual Report*. Winnipeg. Various Issues.

Canadian Wheat Board Act. office consolidation, Oct. 19, 1987.

Capel, R.E., and L.R. Rigoux. 1974. "Analysis of Export Demand for Canadian Wheat." *Canadian Journal of Agricultural Economics*, 22(July 1974): 1-15.

Capel, R.E. "Predicting Wheat Acreage in the Prairie Provinces." *Canadian Journal of Agriculture Economics.* 16,2(June 1968): 87-89.

Caplan, Joseph. "Toward A Market-Oriented Canadian Grain Economy." *Canadian Journal of Agricultural Economics.* 18,1(February 1970):20-35.

Carlos, Ann M. "Land Use, Supply, and Welfare Distortions Induced by Inefficient Freight Rates." *Canadian Journal of Economics.* : 835-845.

Carter, C. A. "Pooling Sales Versus Forward Selling and the Management of Risk: The Case of Wheat." *In International Agricultural Trade-* Advanced readings in Price Formation, Market Structure, and Price Instability. Gary G. Storey, Andrew Schmitz, and Alexander H. Sarris (eds.). Westview Press Inc., Boulder Colorado, 1984.

Carter, C.A., A.B. Hickson, and D.F. Kraft. "The Welfare Effects of Export Constraints on the Canadian Feed Grain Market." *Canadian Journal of Agricultural Economics*. 32(March 1984):25-36.

Carter, C.A. "*The System of Marketing Grain in Canada.*" Department of Agriculture Economics and Farm Management, Faculty of Agriculture, University of Manitoba, Winnipeg, Manitoba, Canada, July 1982. Extension Bulletin #82-2.

Chiang, Alpha C. "*Fundamental Methods of Mathematical Economics.*" Second Edition. McGraw - Hill, Inc. 1967.

Churchill Working Group Efficiency Subcommittee. "Comparative Costs of Moving Grain through the West Coast, Thunder Bay, and Churchill." *Report to the Senior Grain Transportation Committee.* Sept. 30 1985.

Clayton, Kenneth C., Thomas Fulton, and John E. Lee, Jr. *Consortium on Trade Research, Agriculture, Trade, and Development: A Comparative Look at U.S., Canadian, and European Community Policies.* United States Department of Agriculture, Economic Research Service, International Economics Division, Washington, 1985.

Cochrane, W.W. "Conceptualizing the Supply Relation in Agriculture." *Journal of Farm Economics.* 37(1955): 1151-76.

Coleman, D. "*Prairie Grain and Oilseed Acreage Response.*" Policy, Planning and Economics Branch, Agriculture Canada. Working Paper 7.

de Janvry, Alain, and Elisabeth Sadoulet. "Agricultural Price Policy in General Equilibrium Models: Results and Comparisons." *American Journal of Agricultural Economics.* 69,2(May 1987): 230-246.

Devine, D. Grant. "The Crowsnest Rate and Prairie Development: To Change or Not To Change." University of Saskatchewan, Department of Agricultural Economics, 1978. Publication #298B.

Doll, John P., and Frank Orazem. *Production Economics, Theory and Practice.* Second Edition. John Wiley and Sons, New York, 1978.

Dorfman, Robert, Paul A. Samuelson, and Robert M. Solow. *Linear Programming and Economic Analysis.* McGraw - Hill Book Company Inc., New York, 1958.

Eckstein, Otto, and Gary Fromm. "The Price Equation." *American Economic Review.* 58,5(December 1968): 1158-1183.

Eckstein, Zvi. "The Dynamics of Agricultural Supply: A Reconsideration." *American Journal of Agricultural Economics.* 67,2(May 1985): 204-14.

Egbert, Alvin C., Earl O. Heady, and Ray F. Brokken. 1964. *Regional Changes in Grain Production: An Application of Spatial Linear Programming.* Agricultural and Home Economics Experiment Station, Iowa State University of Science and Technology. Ames, Iowa, January 1964. Research Bulletin 521.

Enke, S. "Equilibrium among Spatially Separated Markets: Solution by Electric Analogue." *Econometrica.* 19,1(1951): 40-47.

Fedelu, Jerry A., Earl O. Heady and Won W. Koo. " A National Grain Transportation Model." *Chapter 12 in Spatial Sector Programming Models in Agriculture.* Iowa State University Press, Ames Iowa, 1975.

Ference, Don and Associates Ltd. "*Economic Development Prospects for the Alberta Wheat Industry.*" Report Prepared for Agriculture Canada, Regional development Branch, Vancouver, British Columbia, March 1985.

Ferguson, C.E. *Microeconomic Theory.* Richard D Irwin Inc., Homewood, Illinois, 1969.

Fox, Karl A., and Richard C. Taeeber. 1955. "Spatial Equilibrium Models of the Livestock Feed Economy." *American Economic Review,* 45,4(September 1955):584-608.

Fruin, Jerry E., and Lonnie Dickerson. *The Potential Impact of Crow Rate Rationalization for Diverting Canadian Grain Exports Through United States Gulf Ports.* Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minnesota, 1985.

Fruin, Jerry E. "Alternative Grain Export Routes from Minnesota and the Dakotas." *In Canadian Transportation Research Forum, Proceedings of the 23rd Forum, Montreal, 1982.*

Furtan, W.H., J. G. Nagy, and G.G. Storey. "The Impact on the Canadian Rapeseed Industry from Changes In Transport and Tariff Rates." *American Journal of Agricultural Economics*, Vol 61,2(1979):238-48.

Gardner, Bruce L. "Futures Prices in Supply Analysis." *American Journal of Agricultural Economics*. 58(February 1976):81-84.

Gemmell Andrew. "*The Mississippi River Waterway: An Alternative Route for Canadian Grain Exports?*" Ottawa: Canadian Transport Commission. WP30-86-3.

Ghosh, Sulltesh K. "A Quadratic Programming Interregional Trade Model: An Application and a Perspective." *Canadian Journal of Agricultural Economics*, 20,2(July 1972):65-77.

Gilmour, Brad, and Peter Fawcett. *The Relationship Between American and Canadian Wheat Prices*. Agriculture Canada, Commodity Market Analysis Division, Marketing and Economics Branch, Ottawa, May 1986.

Gilson, J.C. "Western Grain Transportation, Report on Consultations and Recommendations." Minister of Supply and Services. Ottawa, Canada. 1982

Grain and Feed Market News, Washington, D.C., Various Issues.

Grain Trade of Canada. Cat. No. 22-201. Various Issues.

Grain Transportation Agency. *Review of the Western Grain Transportation Act*. Winnipeg, April 1986.

Griffith, G.R., and K.D. Meilke. *A structural Econometric Model of the World Markets for Rapeseed, Soybeans and Their Products*. School of Agricultural Ontario Agricultural College, Economics and Extension Education, University of Guelph, Guelph, Ontario. April 1982.

Groenewegen, John R. 1986. "A Perspectitve on Canadian Wheat Board Exports, Price Pooling, and West Coast Capacity Constraints." *Canadian Journal of Agricultural Economics*. 34,3(November 1986):331-345.

Groenwegen, John R. *Canadian Wheat Board Price Pooling and West Coast Capacity*. Presented to the University of Manitoba Transportation Instititute Workshop on Grain Transportation Research, Winnipeg, September 9, 1986.

Guedry, L.J. "An Application of a Multi-Commodity Transportation Model to the U.S. Feed Grain Economy." Louisiana State University. in *Studies in Economic Planning Over Space and Time*. Katholieke Universiteit te Leuven.

Haas, John T. "Application of Spatial Models to Improving the Efficiency of a Country Hog Marketing System." *Southern Journal of Agricultural Economics*. Vol. No. 1974(July)143-149.

Hall, Harry H., Arthur L. Stoecker, and Earl O. Heady. "Quadratic Programming of Spatial Equilibrium." *In Spatial Sector Programming Models in Agriculture*, eds. Earl O. Heady and Uma K. Srivastava. Iowa State University Press, Ames. 1975.

Hall, Harry H., Earl O. Heady, and Yakir Plessner. "Quadratic Programming Solution of Competitive Equilibrium for U.S. Agriculture." *American Journal of Agricultural Economics.* Vol. 50, Part 1 1968.

Harling, Kenneth F., and Robert L. Thompson. "The Economic Effects of Intervention in Canadian Agriculture." *Canadian Journal of Agricultural Economics*, 31(July 1983):153-173.

Harvey, D.R. "Government Intervention and Regulation in the Canadian Grains Industry." *University of Newcastle Upon Tyne, Newcastle Upon Tyne, England, Published for the Economic Council of Canada*, June 1981. Technical Report E116.

Harvey, David R. *An Economic Analysis of the Crow's Nest Pass Freight Rates Re-Visited*. A working paper prepared for Agriculture Canada. University of Newcastle upon Tyne, Department of Agricultural Economics, Newcastle upon Tyne, England, 1981. Discussion Paper.

Heady, E.O., and V.K. Srivastava. *Spatial Sector Programming Models in Agriculture.* Ames, Iowa, Iowa State University Press, 1965.

Henderson, James M., and Richard E. Quant. *Microeconomic Theory - A Mathematical Approach.* Thrid Edition. McGraw-Hill Book Company. 1980.

Hickson, A.B. and C.A. Carter. "An Analysis of Policy Changes in the Canadian Feed Grain Market." *Western Journal of Agriculture Economics.* 12(2): 126-134, 1987.

Hillier, Frederick S., and Gerald J. Lieberman. *Introduction to Operations Research.* Holden - Day, Inc., San Francisco, California, 1968.

Houck, James P. *Elements of Agricultural Trade Policies.* MacMillian Publishing Company, New York, 1986.

House of Commons. *Bill C-155.* November 14 1983.

Huff, Bruce H. and Zuhair A Hassan, Ed. *"Agriculture Sector Models for Policy Analysis."* Commodity Markets Analysis Division, Marketing and Economics Branch, Agriculture Canada. Ottawa, Ontario. 1985.

International Wheat Council. 1986. *World Wheat Statistics.*

Jonnson, Aron C., Marvin B. Johnson, and Rueben C. Buse. *Econometrics Basic and Applied.* Macmillian Publishing Company. 1987.

Jolly, Robert W., and Martin E. Abel. *An Econometric Analysis of Canada's Wheat and Feed Grain Economy with Emphasis on Commercial Agricultural Policy.* University of Minnesota, Department of Agricultural and Applied Economics, 1978.

Josling, Tim. "Government Price Policies and the Structure of International Agricultural Trade." *Journal of Agricultural Economics.* 28,2(1977): 261-277.

Judge, G.G., J. Havlicek and R.L. Rizek. "A Spatial Analysis of the U.S. Livestock Economy." In *Studies in Economic Planning Over Space and Time* - Contributions to Economic Analysis. George G. Judge, (eds.). North-Holland/American Elsevier, 1973.

Kirk, Bruce. *Agricultural Impacts of Crow Change - Final Report.* Agriculture Canada, Food Markets Analysis Division, Marketing and Economics Branch. February 1983.

Koo, Won W., and D.W. Larson eds. *Transportation Models for Agricultural Products.* Westview Press, Boulder Colorado, 1985.

Koo, Won W., and Ihn H. Uhm. "United States and Canadian Rail Freight-Rate Structures: A Comparative Analysis." *Canadian Journal of Agricultural Economics.* 32,2(July 1984):301-326.

Koo, Won W. "Effects of Government Programs on Wheat Acreage Response in the U.S. and Canada." *Journal of Rural Development.* 7(December 1984): 151-162.

Koo, Won W. "Grain Marketing and Transportation System under the Current and Cost-Base Rate Structure." North Central Journal of Agriculture Economics. 42,2(July 1982).

Koo, Won W. "Impacts on Agriculture of Deregulating the Transportation System: Comment." American Journal of Agricultural Economics. 65,1(1983).

Kraft, Daryl F. *"An Evaluation of the Canadian Wheat Board Proposal to Increase Transportation Charges to Thunder Bay."* Unpublished paper, University of Manitoba, Winnipeg, 1986.

Krakar, E. Food and Agricultural Regional Model - Grain and Oilseed Component. *Agriculture Canada, Commodity Markets Analysis Division, Marketing and Economics Branch* August 1985. Working Paper 11/85.

Kraker, Eileen, and Brian Paddock. *A Systems Approach to Estimating Prairie Crop Acreage*. Agriculture Canada, Commoditiy Market Analysis Division, Marketing and Economics Branch, 1985. Working Paper 15.

Kulshreshtha, Surendra W., and D. Grant Devine. "Historical Perspectives and Propositions on the Crowsnest Pass Freight Rate Agreement." *Canadian Journal of Agricultural Economics.* 26(1978): 72-83.

Kulshreshtha, Surendra W., and D. Grant Devine. *The Crowsnest Rate and Prairie Development: A Historical Review*. University of Saskatchewan, Department of Agricultural Economics, Transportation 843, Revised June 1978, First Published May 1976. Publication #298A.

Labys, W.C. *Dynamic Commodity Models: Specification, Estimation and Simulation.* Heath and Company, Lexington, Mass. 1973.

Labys, Walter C., and Peter K. Pollak. *Commodity Models For Forecasting and Policy Analysis*. Croomhelm Ltd., Provident House, Burrel Row, Beckenhan, Kent, Australia, 1984.

Ladd, George W., and Dennis R. Lifferth. "An Analysis of Alternative Grain Distribution Systems." *American Journal of Agricultural Economics*. 57,3(August 1975): 420-430.

Lee, T.C., and S.K. Seaver. "A Positive Spatial Equilibrium Model Of Broiler Markets: A Simultaneous Equation Approach." *University of Connecticut, Agricultural Experimental Station, College of Agriculture and Natural Resources,* Connecticut (Storrs), 1972. Bulletin #417.

Leftwich, Richard H. *The Price System and Resource Allocation.* Sixth Edition. The Dryden Press, New York, 1976.

Leibfried, James L. *Grain Handling Efficiency Study.* Final Report. Grain Transportation Agency, Winnipeg, April 17, 1987.

Leitch, D.A. (Ed.). The Future of the Great Lakes - St. Lawrence Seaway System. The Unversity of Manitoba Transport Institute, Winnipeg, June 1986. Occasional Paper No. 2.

Lerohl, M.L. "East-West Pooling and Some Effects on Alberta Farmers." *Agriculture-Forestry Bulletin*, 10:2(Summer 1987):13-16.

Lerohl, M.L. "*The Next Five Years of the WGTA: A View from the Western Prairies.*" Comments to UMTI Seminar, The Future of the WGTA." Winnipeg, June 21 1988.

Leunis, J.V., and R.J. Vandenborre. "An Interregional Analysis of the United States Soybean Industry." In *Studies in Economic Planning Over Space and Time* - Contributions to Economic Analysis. George G. Judge, (eds.). North-Holland/American Elsevier, 1973.

Libbin, James D. "*A User's Guide to the IBM MPSX Linear Programming Package.*" University of Illnois, College of Agriculture, Department of Agricultural Economics, Urbana-Champaign, June 1973.

Longworth, John W., and Phillip Knopke. "Australian Wheat Policy 1948-79: A Welfare Evaluation." *American Journal of Agricultural Economics.* 64,4, (November 1982):642-654.

Lyons, R.M.A., and Colin Carter. *Grains in Western Canadian Economic Development to 1990.* University of Manitoba, Department of Agriculture Economics, Winnipeg, 1984. Discussion Paper #272.

MacGregor, R.J. and J.D. Graham. "The Impact of Lower Grains and Oilseeds Prices on Canada's Grains sector: A Regional Programming Approach." *Canadian Journal of Agriculture Economics*. 36(1988) 51-67.

MacLaren, Donald. "Canadian Wheat Exports in the International Market: An Explanatory Econometric and Policy Analysis." *Canadian Journal of Agricultural Economics*, 25,1(1977):31-54.

Malmberg, L.A., and Lakeside Research. *An Analysis of the Impact of the Alberta Feed Grain Market Adjustment Program, Part One.* Lakeside Research, A Division of Lakeside Feeders Ltd., Brooks, Alberta. June 1986.

Malmberg, L.A. "*The Anatomy of the Canadian Barley Market.*" Prepared for Alberta Agriculture, Planning and Research Secretariat. Edmonton, July 1980.

Maniak, Sandra J. "*Optimal Deliveries of Wheat In Canada: The Impact of CWRS Wheat Grade Multiplicity on Transportation Cost Minimization.*" Unpublished Master of Arts Thesis, Department of Geography, University of Alberta, Edmonton, Alberta, Spring 1984.

Martin, Larry, and Anthony C. Zwart. "A Spatial and Temporal Model of the North American Pork Sector for The Evaluation of Policy Alternatives." *American Journal of Agricultural Economics*, 57(February, 1975): 55-66.

Martin, Larry. "Quadratic Single and Multi - Commodity Models of Spatial Equilibrium - A Simplified Exposition." *Canadian Journal of Agricultural Economics.* 29,2(1981): 21-48.

Martin, Larry. "*Spatial Programming Models: An Evaluation.*" University of Guelph, School of Agricultural Economics and Extension education, unpublished paper.

McCalla, Alex F., and Andrew Schmitz. "Grain Marketing Systems: The Case of the United States versus Canada." *American Journal of Agricultural Economics*, 61,2(May 1979):199-212.

Meilke, K.D. "Acreage Response to Policy Variables in the Prairie Provinces." *American Journal of Agricultural Economics.* 58,3(1976): 572-77.

Meilke, Karl. *A Comparison of the Simulation Results From Six International Trade Models.* University of Guelph, Department of Agricultural Economics and Business, Guelph, Ontario, February 1987. Working Paper WP87/3.

Meyer, Robert A. *Microeconomic Decisions.* University of California, Berkely. Houghton Mifflin Company, 1976.

Mishan, E.J. "What Is Producer Surplus?" *American Economic Review.* 58,5(December 1968): 1269-1282.

Morzuch, B.J., Weaver, R.D., and Helmberger, P.G. "Wheat Acreage Supply Response under Changing Farm Programs." American Journal of Agricultural Economics. 62(1):29-37. 1980.

Moschini, Giancarlo, and Karl D. Meilke. *An Analysis of Spatial Price Differences in the North-American Livestock Sector*. Interim Report. Agriculture Canada, Ottawa, 1987. Working Paper 7/87.

Olsen, B.T., and H.G. Brooks. "Canadian Wheat Board Proposal: Basic Change for Initial Payment Freight Deduction." Draft copy for 1986 A.I.C. proceedings issue of the *Canadian Journal of Agricultural Economics.*

Olsen, K., E.W. Tyrchniewicz and C.F. Framingham. "Impact of Changes in Statutory Grain Rates and Rail Branchline Configurations on Manitoba's Agricultural Economy." *Special Report Prepared under Contract for the Government of Manitoba*, March 1980.

Oregon State University. *An Econometric Model of Barley Acreage Response to Changes in Prices and Wheat Acreage in the Northwest.* Oregon State University, Agricultural Experiment Station, Corvallis, Oregon, January 1982. Special Report #647.

Paarsch, Harry J. "Micro-Economic Models of Beef Supply." *Canadian Journal of Economics.* 18,3(August 1985): 636-649.

Paddock, B.W. "Supply Analysis of Rapeseed Acreage." *Canadian Journal of Agricultural Economics.* 19,1(July 1971): 110-15.

Pfeiffer, George H. *MPS-PC Linear Programming System*, Program Manual, 1984.

Ports Canada. *Distribution Costs of Prairie Wheat to Pacific and St. Lawrence Ports.* November 1986. Information Bulletin No. 2.

Rausser, G.C., and D.P. Stonehouse. "Public Intervention and Producer Supply Response." *American Journal of Agricultural Economics*. 60,5(December 1978): 885-90.

Ryan, Timothy J. "Wheat Marketing." *Review of Marketing and Agricultural Economics*, 5,2(August 1984): 117-127.

Sampson, J.A. and C.D. Gerrard. "Government Intervention and the Production of Wheat in Saskatchewan and North Dakota: An Empirical Analysis." Canadian Journal of Agriculture Economics. 35,1(March 1987).

Samuelson, Paul A. "Spatial Price Equilibrium and Linear Programming." *American Economic Review*, 42,1(March 1952): 283-303.

Sasaki, Kozo. "Spatial Equilibrium Analysis of Livestock Products in Eastern Japan." In *Studies in Economic Planning Over Space and Time* - Contributions to Economic Analysis. George G. Judge, and T. Takeyama (eds.) North-Holland/American Elsevier. pp. 419-463.

Schmitz, A. "A Canadian Wheat Acreage Response." *Canadian Journal of Agricultural Economics.* 16(1968): 79-86.

Schmitz, Andrew, and Alex McCalla. 1979. "The Canadian Wheat Board." In *Agricultural Marketing Boards-An International Perspective.* Sidney Hoos, and Kenneth Farrell (Eds.). Ballinger Publishing Company, United States, 1979.

Schmitz A., and Bawden D. Lee. *World Wheat Economy: An Empirical Analysis*. Giammini Foundation Monograph: No. 3. University of California, Berkeley. 1973.

Schweitzer, Thomas T. Old Myths and New Choices: Railway Freight Rates and Western Economic Development. *Economic Council of Canada*, 1984. Discussion Paper #269.

Shumway, C. Richard, and Anne A. Chang. "Linear Programming versus Positively Estimated Supply Functions: An Empirical and Methodological Critique." *American Journal of Agricultural Economics.* 59(1977): 344-357.

Sinner, J.A., D. Blandford, and K.L. Robinson. *Canadian Wheat Export Behavior and its Implications for the U.S.* Department of Agriculture Economics. Cornell University, Ithaca. Research Report 87-23. 1987.

Spriggs, John. "An Econometric Analysis of Canadian Grains and Oilseeds." *United States Department of Agriculture*, Washington, D.C., 1981. Technical Bulletin #1662.

Stackhouse, John. "The Objectives of Trade in Spatial Equilibrium." Nova Scotia Agricultural College, Department of Economics and Business, 1980. Unpublished paper.

Statistics Canada, Natural Resources Division, *Prairie Provinces-by Crop District - Area, Yield and Production*, Ottawa, computer printout, 1965-1985.

Stickland K. *Proposal on the new C.W.B. pricing Alternative*. Unpublished paper. 1985.

Storey, Gary C., and Surendra N. Kulshreshtha. "An Evaluation of Pricing Performance of the Canadian Feed Grains Policy." *Canadian Journal of Agricultural Economics.* 29,1(February 1981): 1-20.

Strotz, Robert H., and H. O. A. Wold. "Recursive vs. Nonrecursive System: An Attempt At Synthesis." *Econometrica*. 28(April 1960):.

Swanson, Leonard W. *Linear Programming: Basic Theory and Applications in Quantitative Methods for Management Series.* McGraw-Hill Inc., New York, 1980.

Takayama, T., and G.G. Judge. "An Intertemporal Price Equilibrium Model." Journal of Farm Economics. 46(1964): 477-484.

Takayama, T., and G.G. Judge. "Spatial Equilibrium and Quadratic Programming." *Journal of Farm Economics*. 40(February 1964): 67-93.

Takayama, T. and G.G. Judge. *Spatial and Temporal Price and Allocation Models*. North Holland Publishing Company. Amsterdam. 1971.

Takayama, T. and Judge, G.G. "Equilibrium among Spatially Separated Markets: A Reformulatiion." *Econometrica*. 32(1964): 510-524.

Takayama T., and A.D. Woodland. "Equivalence of Price and Quantity Formulations of Spatial Equilibrium: Purified Duality in Quadratic and Concave Programming." *Ecomometrica*. 38,6(November 1970).

Thompson, R.L. *A Survey of Recent United States Developments In International Agricultural Trade Models*. USDA, Research Service, Washington, D.C., September 1981. Bulletin #21,

Tyrchniewicz, E.W. "Western Grain Transportation Initiatives: Where Do We Go From Here?" *Canadian Journal of Agricultural Economics*. 32:2(July 1984): 253-268.

United States Department of Agriculture. *Regional Adjustments in Grain Production: A Linear Programming Analysis of Mathematical Models, Proofs, Methods of Data Collection and Estimation, and Supplementary Tables*. USDA, Agriculture Research Service, Farm Economics Research Division, Agricultural Research Service, Washington, June 1981.

Veeman, M.M., and T.S. Veeman. *The Future of Grain: Canada's Prospects for Grains, Oilseeds, and Related Industries*, Ottawa, 1984.

Warley, T.K. "Canada's Agricultural and Food Trade Policies: A Synoptic View." A working paper prepared for a project of the Trilateral Commission entitled *Agricultural Policy and Trade: Adjusting Domestic Regimes in an International Framework*. February 1, 1985.

Weaver, G.D., M.J. Nilsson, and R.E. Turney. "Handling System Requirements-1990." In *Prospects for the Prairie Grain Industry-1990*. Canada Grains Council, Winnipeg, November 1982.

Weinschenck, G., W. Henrichsmeyer and F. Aldinger.1969. "The Theory of Spatial Equilibrium and Optimal Location in Agriculture: A Survey." In *Review of Marketing and Agricultural Economics*. C.D. Throsby (ed.). 37,1(March 1969): 3-70.

Wilson, A.G. "An Assessment of Present Feed Grains Marketing Policy in Canada." Canada Grains Council Sixth Annual Semi-Annual Meeting at Toronto. October 29, and 30, 1975.

Wilson, Margaret A., and Peter E. Sandor. "Forecast of Canadian Grain Shipments Through the St. Lawrence Seaway." *In Canadian Transportation Research Forum, Proceedings of the 23rd Forum, Montreal, 1982.*

World Grain. 4,4(May 1986).

Zwart, A.C., and Meilke, K.D. "The Influence of Domestic Agricultural Policies on International Price Stability." *American Journal of Agricultural Economics*. 61,4(1979): 434-47.

APPENDIX A.

VALIDATION OF SUPPLY ANALYSIS
AND
BASELINE SUB-REGIONAL RESULTS

Calculated Variable:

REWFC = (PRICEW - TRANSFC)/36.74
RECFC = (PRICEC - TRANSFC)/44.09
REBFC = (PRICEB - TRANSFC)/45.93
RECP = (PRICEC - TRANSP)/44.09
REBP = (PRICEB - TRANSP)/45.93
REWP = (PRICEW - TRANSP)/36.74
REWFB = (PRICEW - TRANSB)/36.74
RECFB = (PRICEC - TRANSB)/44.09
REBFB = (PRICEB - TRANSB)/45.93
REBB = (PRICB - TRANSBR)/45.93
RPRICCB = (PRICEC - TRANSBV)/44.09
REWFC = (PRICEW - TRANSBR)/36.74
REWSR = (PRICEW - TRANSS)/36.74
RECSR = (PRICEC - TRANSSV)/44.09
REBSR = (PRICEB - TRANSS)/45.93
RECSA = (PRICEC - TRANVAN)/44.09
REBSA = (PRICEB - TRANSA)/45.93
REWSA = (PRICEW - TRANSA)/36.74
REBS = (PRICEB - TRANSR)/45.93
RECS = (PRICEC - TRANSR/44.09
REWS = (PRICEW - TRANSR)/36.74
QUOTA = LAG(QUOTA) - LAGGED ONE PRODUCTION PERIOD

Variable Description	Units
CAA456 Total Canola Production	'000 Bu.
ABP456 Total Barley Production	'000 Bu.
ASW456 Total Wheat Production	'000 Bu.
CAA7 Total Canola Production	'000 Bu.
ASW7 Total Wheat Production	'000 Bu.
ABP7 Total Barley Production	'000 Bu.
ACP123 Total Canola Production	'000 Bu.
AWP123 Total Wheat Production	'000 Bu.
ABP123 Total Barley Production	'000 Bu.
MCAP Total Canola Production	'000 Bu.
MWP Total Wheat Production	'000 Bu.
MBP Total Barley Production	'000 Bu.
SCP14 Total Canola Production	'000 Bu.
SWP14 Total Wheat Production	'000 Bu.
SBP14 Total Barley Production	'000 Bu.
BPS568 Total Barley Production	'000 Bu.
WPS568 Total Wheat Production	'000 Bu.
CPS568 Total Canola Production	'000 Bu.
SCP79 Total Canola Production	'000 Bu.
SWP79 Total Wheat Production	'000 Bu.
SBP79 Total Barley Production	'000 Bu.
PRICEW Canadian Red Spring Wheat, C.W.B. Initial Price	$/Tonne
PRICEC Canola, March Contract Price, Vancouver	$/Tonne
PRICEB No. 1 Feed Barley, C.W.B. Initial Pice	$/Tonne
TRANSFC Producer Transportation Cost (Camrose) to Vancouver	$/Tonne
TRANSP Producer Transportation Costs (Peace River) to Vancouver	$/Tonne
TRANSB Producer Transportation Costs (Brooks) to Vancouver	$/Tonne

TRANSBR Producer Transportation Costs (Brandon) to Thunder Bay.	$/Tonne
TRANSBV Producer Transportation Costs (Brandon) to Vancouver.	$/Tonne
TRANSS Producer Transportation Costs (Regina) to Thunder Bay	$/Tonne
TRANSSV Producer Transportation Costs (Regina) to Vancouver	$/Tonne
TRANSA Producer Transportation Costs (Saskatoon) to Thunder Bay	$/Tonne
TRANVAN Producer Transportation Costs (Saskatoon) to Vancouver	$/Tonne
TRANSR Producer Transportation Costs (Scott) to Vancouver	$/Tonne
REWFC Farm Gate Returns, Wheat	$/Bu.
RECFC Farm Gate Returns, Canola	$/Bu.
REBFC Farm Gate Returns, Barley	$/Bu.
REBP Farm Gate Returns, Barley	$/Bu.
RECP Farm Gate Returns, Canola	$/Bu.
REWP Farm Gate Returns, Wheat	$/Bu.
REWFB Farm Gate Returns, Wheat	$/Bu.
RECFB Farm Gate Returns, Canola	$/Bu.
REBFB Farm Gate Returns, Barley	$/Bu.
REBB Farm Gate Returns, Barley	$/Bu.
RPRICCB Farm Gate Returns, Canola	$/Bu.
REWB Farm Gate Returns, Wheat	$/Bu.
RECSR Farm Gate Returns, Canola	$/Bu.
REWSR Farm Gate Returns, Wheat	$/Bu.
REBSR Farm Gate Returns, Barley	$/Bu.
RECSA Farm Gate Returns, Canola	$/Bu.
REBSA Farm Gate Returns, Barley	$/Bu.
REWSA Farm Gate Returns, Wheat	$/Bu.
REBS Farm Gate Returns, Barley	$/Bu.
RECS Farm Gate Returns, Canola	$/Bu.
REWS Farm Gate Returns, Wheat	$/Bu.
DUM78 Dummy Variable, 1978-1979 Increase in Canola Price	1 = 1978-1979, 0 Otherwise
DUM70 Dummy Variable, 1970 LIFT	1 = 1970, 0 Otherwise
DUM71a Dummy Variable, 1971-1973, After affects of LIFT.	1 = 1971 - 1973, 0 Otherwise
DUM71 Dummy Variable, 1971-1972, After affects of LIFT.	1 = 1971-1972, 0 Otherwise
DUM73 Dummy Variable, 1973-1974, After Affects of LIFT	1 = 1973-1974, 0 Otherwise
DUML Dummy Variable, 1970-1974, After Affects of LIFT	1 = 1970-1974, 0 Otherwise
DUMAL Dummy Variable, 1970 - 1973, After Affects of LIFT	1 = 1970-1973, 0 Otherwise
QUOTA Lagged Quota Index	-

Table A-1 Canola Supply in Region 456 - Alberta

Ordinary Least Squares Regression

Dependent Variable	CAA456
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	4456.8
Mean of Dependent Variable	17,574
Sum of Squared Residuals	1,234.4
R-Squared	0.88
Adjusted R-Squared	0.85
Durbin Watson Statistic	1.77
Estimated Autocorrelation (Rho)	0.09
F-Statistic - From Mean	33.83
F - Statistic - From Zero	95.41

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
RECFC	2,121	958	2.21	0.64	100.06	4141
REWFC	3,995	2,061	1.94	0.58	- 352.7	8343
DUM78	9,534	3,835	2.49	0.05	-	-
CONST.	-4,615	3,871	-1.19	-	-	-

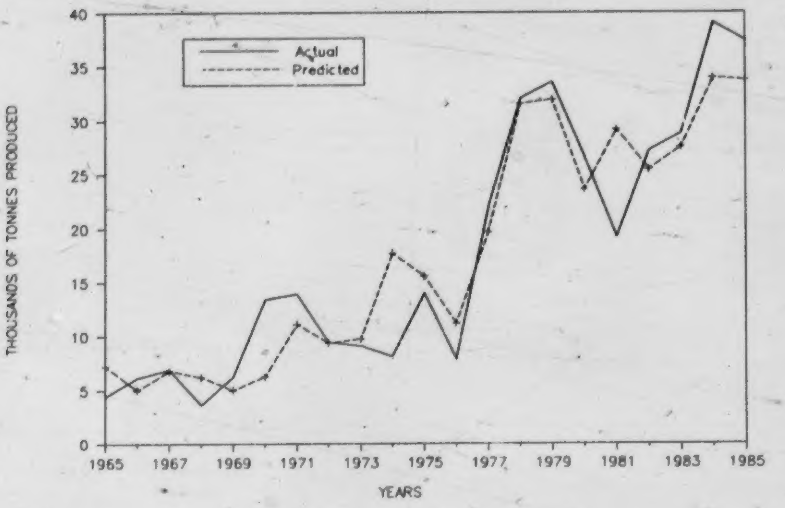


Figure A-1 Actual vs. Predicted Canola Production - Alberta 456

Table A-2 Wheat Supply in Region 456 - Alberta

Ordinary Least Squares Regression

Dependent Variable	ASW456
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	6,647.7
Mean of Dependent Variable	53,319
Sum of Squared Residuals	-75,488
R-Squared	0.85
Adjusted R-Squared	0.82
Durbin Watson Statistic	1.77
Estimated Autocorrelation (Rho)	0.08
F - Statistic - From Mean	22.3
F - Statistic - From Zero	275.2

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REWFC	17,995	2,296	2.60	0.88	13,103	22,887
RECFC	- 6,653	7,262	5.38	- 0.68	- 9,287	-4,019
DUM70	- 18,860	7,262	2.60	- 0.02	-	-
QUOTA	3,090	1,055	2.93	0.17	841.8	5,338
CONST.	34,634	4,513	7.67	-	-	-

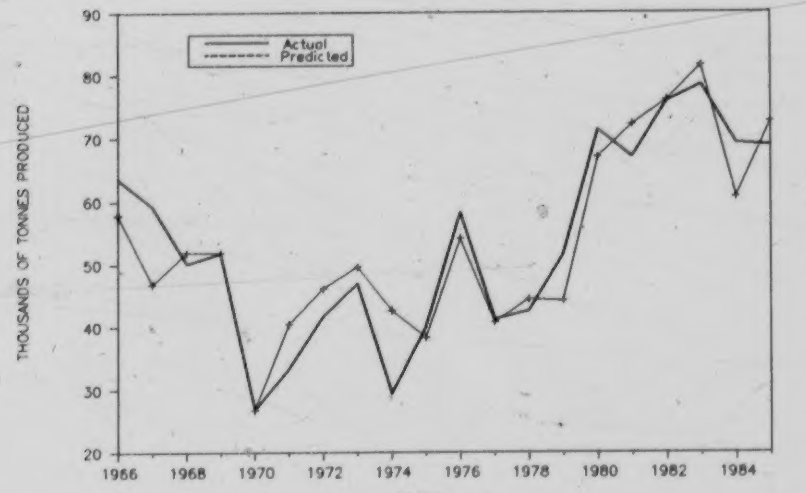


Figure A-2 Actual vs. Predicted Wheat Production - Alberta 456

Table A-3 Barley Supply in Region 456 - Alberta

Ordinary Least Squares Regression

Dependent Variable	ABP456
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	14,428
Mean of Dependent Variable	111,100
Sum of Squared Residuals	105,500
R-Squared	0.78
Adjusted R-Squared	0.74
Durbin Watson Statistic	1.84
Estimated Autocorrelation (Rho)	0.01
F-Statistic - From Mean	20.04
F - Statistic - From Zero	287.3

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REBFC	40,498	10,356	3.91	0.51	18,648	62,348
RECFC	1,484	2,669	0.56	0.07	- 4,146	7,114.7
DUM71	32,619	10,668	3.06	0.04	-	-
CONST.	41,908	9,808	4.27	-	-	-

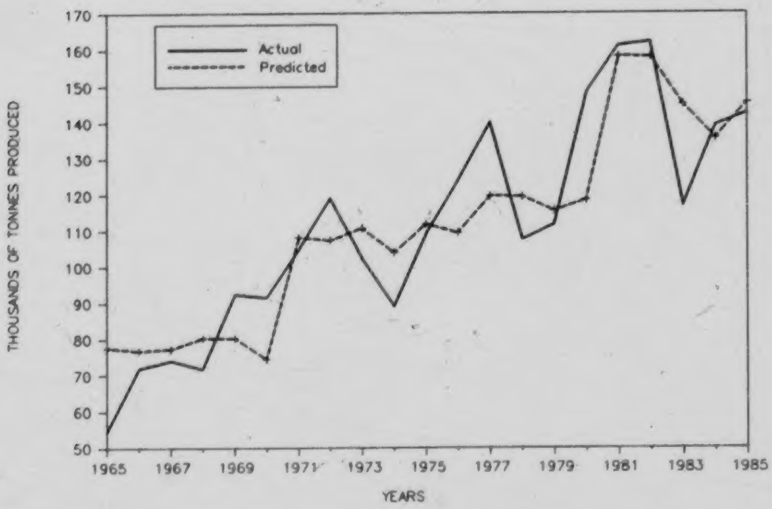


Figure A-3 Actual vs. Predicted Barley Production - Alberta 456

Table A-4 Canola Supply in Region 7 - Alberta

Ordinary Least Squares Regression

Dependent Variable	CAA7
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	2.662.4
Mean of Dependent Variable	8,816.0
Sum of Squared Residuals	1,650.7
R-Squared	0.67
Adjusted R-Squared	0.62
Durbin Watson Statistic	1.69
Estimated Autocorrelation (Rho)	0.12
F - Statistic - From Mean	
F - Statistic - From Zero	

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
RECP	1,700.4	493.20	3.45	1.02	659.80	2,741.0
REBP	-3,849.60	2,010.0	1.91	0.60	-8,090.6	391.43
DUM71	894.52	2,350.3	0.38	0.004	-	-
CONST.	4,893.5	2,762.9	1.77	-	-	-

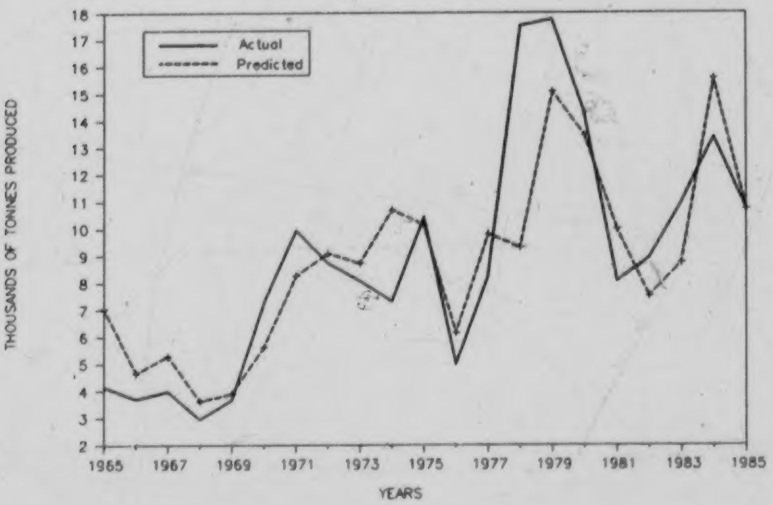


Figure A-4 Actual vs. Predicted Canola Production - Alberta 7

Table A-5 Wheat Supply in Region 7 - Alberta

Ordinary Least Squares Regression

Dependent Variable	ASW7
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	3,732.3
Mean of Dependent Variable	12,899
Sum of Squared Residuals	363,800
R-Squared	0.80
Adjusted R-Squared	0.75
Durbin Watson Statistic	2.08
Estimated Autocorrelation (Rho)	0.04
F - Statistic - From Mean	15.34
F - Statistic - From Zero	60.05

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REWP	8,464.	1,288.	6.57	1.69	5,718	11,211
RECP	-2,595.	693.8	3.74	1.09	-4,074	-1,117
DUM70	-4,625.3	4,077	1.13	0.02	-	-
QUOTA	830.	592.3	1.40	0.19	-432.	2,092
CONST.	2,959.	2,525.	1.17	0.23		

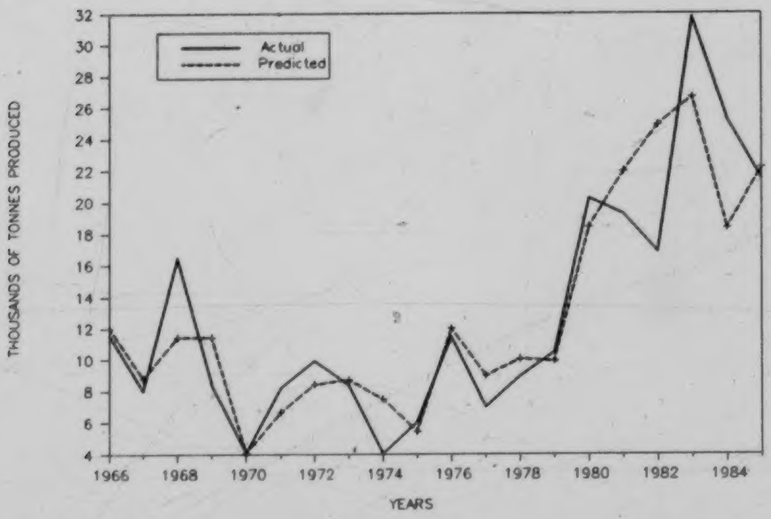


Figure A-5 Actual Vs. Predicted Wheat Production - Alberta 7

Table A-6 Barley Supply in Region 7 - Alberta

Ordinary Least Squares Regression

Dependent Variable	ABP7
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	5,953.6
Mean of Dependent Variable	28,756
Sum of Squared Residuals	151,890
R-Squared	0.57
Adjusted R-Squared	0.52
Durbin Watson Statistic	1.91
Estimated Autocorrelation (Rho)	0.08
F-Statistic - From Mean	11.72
F - Statistic - From Zero	171.12

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REBP	20,157	7,355.7	2.74	0.97	4,702.8	35,612
REWP	- 5,828.2	3,816.0	1.53	0.51	-13,846	2,189
CONST.	15,613	3,101.2	5.03	-	-	-

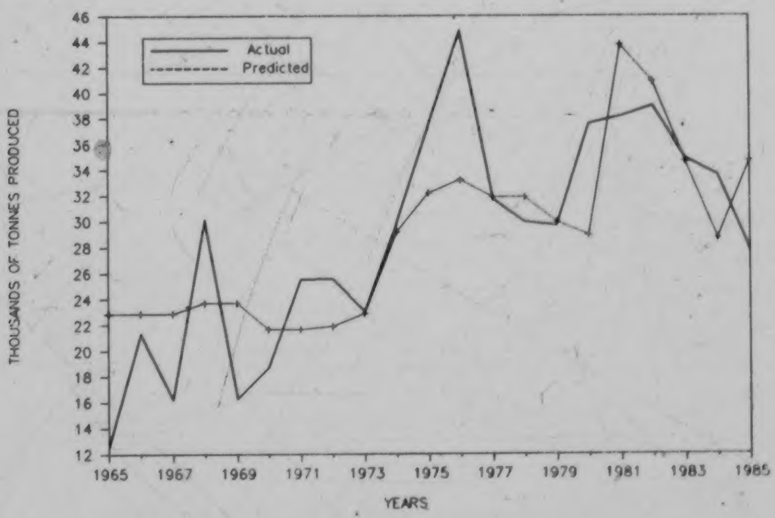


Figure A-6 Actual vs. Predicted Barley Production - Alberta 7

Table A-7 Canola Supply in Region 123 - Alberta

Ordinary Least Squares Regression

Dependent Variable	ACP123
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	1,596.4
Mean of Dependent Variable	5,438.6
Sum of Squared Residuals	972.14
R-Squared	0.84
Adjusted R-Squared	0.79
Durbin Watson Statistic	1.93
Estimated Autocorrelation (Rho)	0.02
F-Statistic - From Mean	
F - Statistic - From Zero	

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
RECFB	536.15	345.18	1.55	0.52	-199.42	1,271
REWFB	2,325	1,351.3	1.72	1.08	-554.73	5,204
DUM73	3,027	1,472.8	2.05	0.02	-	-
DUM78	5,864.5	1,381.0	4.25	0.10	-	-
REBFB	-3,698.5	2,154.0	1.71	0.95	-8,288.7	891.6
CONST.	1,036.7	1,434.4	0.72	-	-	-

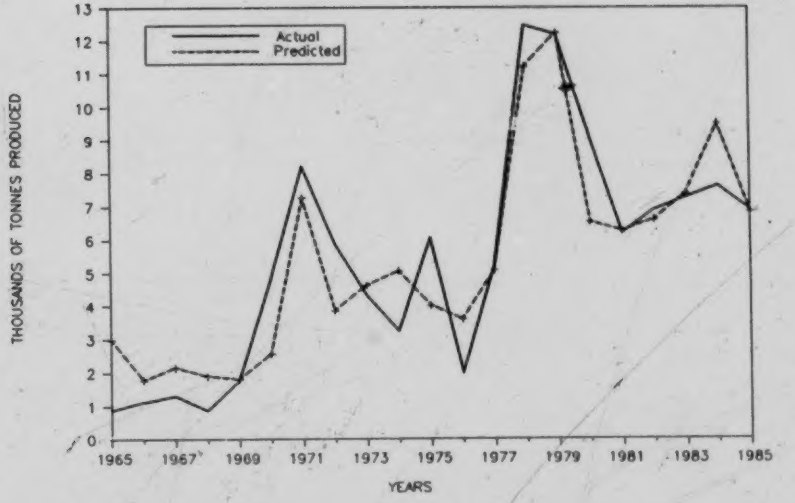


Figure A-7 Actual vs. Predicted Canola Production - Alberta 123

Table A-8 Wheat Supply in Region 123 - Alberta

Ordinary Least Squares Regression

Dependent Variable	ASP123
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	13,088
Mean of Dependent Variable	76,767
Sum of Squared Residuals	-9,240.7
R-Squared	0.75
Adjusted R-Squared	0.68
Durbin Watson Statistic	1.73
Estimated Autocorrelation (Rho)	0.01
F - Statistic - From Mean	
F - Statistic - From Zero	

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REWFB	20,154	6,085	3.31	0.68	7,185.5	33,122
RECFB	- 9,599.2	2,723	3.53	0.68	-15,402	-3,796
DUM70	- 30,504	11,987	2.54	0.02	-	-
QUOTA	5,801.4	2,080	2.79	0.22	1,368.6	10,234
CONST.	60,999	17,799	4.42	-	-	-

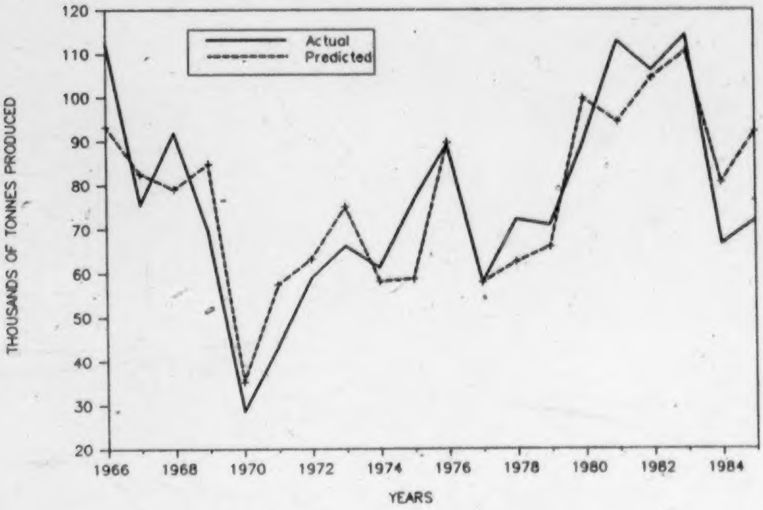


Figure A-8 Actual vs. Predicted Wheat Production - Alberta 123

Table A-8 Barley Supply in Region 123 - Alberta

Ordinary Least Squares Regression

Dependent Variable	ABP123
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	13,235
Mean of Dependent Variable	76,909
Sum of Squared Residuals	9,318.2
R-Squared	0.60
Adjusted R-Squared	0.54
Durbin Watson Statistic	2.16
Estimated Autocorrelation (Rho)	0.14
F-Statistic - From Mean	
F - Statistic - From Zero	

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elas.	Lower	Upper
REBFB	37,195	10,468	3.55	0.67	15,107	59,282
RECFB	- 6,353	2,369	2.68	0.44	-11,351	-1,354
DUM71	16,278	10,428	1.56	0.02	-	-
CONST.	50,976	18,426	2.77	-	-	-

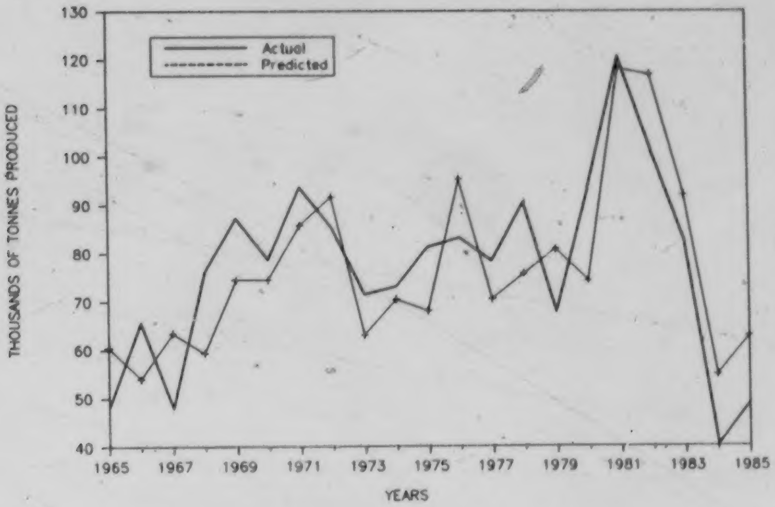


Figure A-9 Actual vs. Predicted Barley Production - Alberta 123

Table A-10 Canola Supply in Manitoba

Ordinary Least Squares Regression

Dependent Variable	MCAP
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	2,784.7
Mean of Dependent Variable	11,905
Sum of Squared Residuals	1,468.4
R-Squared	0.91
Adjusted R-Squared	0.89
Durbin Watson Statistic	1.37
Estimated Autocorrelation (Rho)	0.16
F-Statistic - From Mean	-
F - Statistic - From Zero	-

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REBB	-4,429.4	3,672.7	1.21	0.53	-12,215	3,356
RPRICCB	1,791.7	593.67	3.01	0.80	533.15	3,050
REWB	4,400.2	2,534.8	1.74	0.95	973.56	9,774
DUM78	12,294	2,340.4	5.25	0.09	-	-
CONST.	-3,417.7	3,395.9	1.01	-	-	-

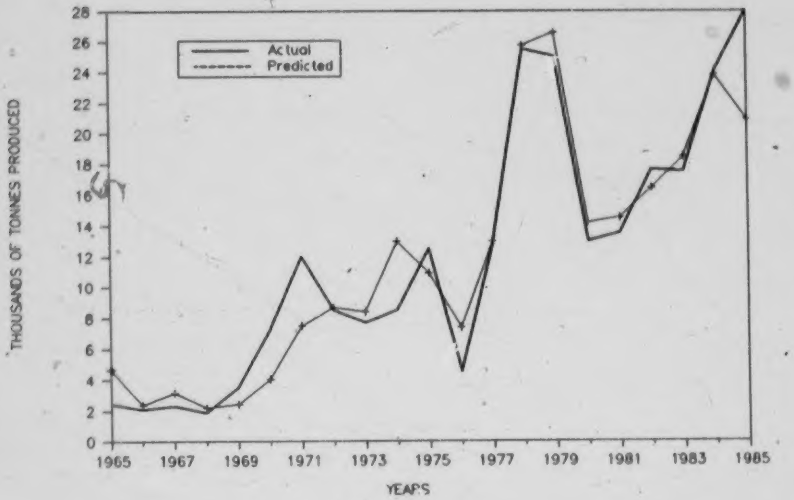


Figure A-10 Actual vs. Predicted Canola Production - Manitoba

Table A-11 Wheat Supply in Manitoba

Ordinary Least Squares Regression

Dependent Variable	MWP
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	20,189
Mean of Dependent Variable	89,515
Sum of Squared Residuals	1,037.2
R-Squared	0.71
Adjusted R-Squared	0.64
Durbin Watson Statistic	1.42
Estimated Autocorrelation (Rho)	0.18
F-Statistic - From Mean	-
F - Statistic - From Zero	-

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REWB	24,784	8,887.7	2.79	0.73	5,992.0	42,618
RPRICCB	-3,104.6	4,167.2	0.75	0.19	-11,695	5,560
DUM70	-36,565	19,098	1.91	0.02	-	-
QUOTA	1,885.8	3,222.5	0.59	0.06	-4,710	6,845
CONST.	39,320	19,664	2.00	0.44	-	-

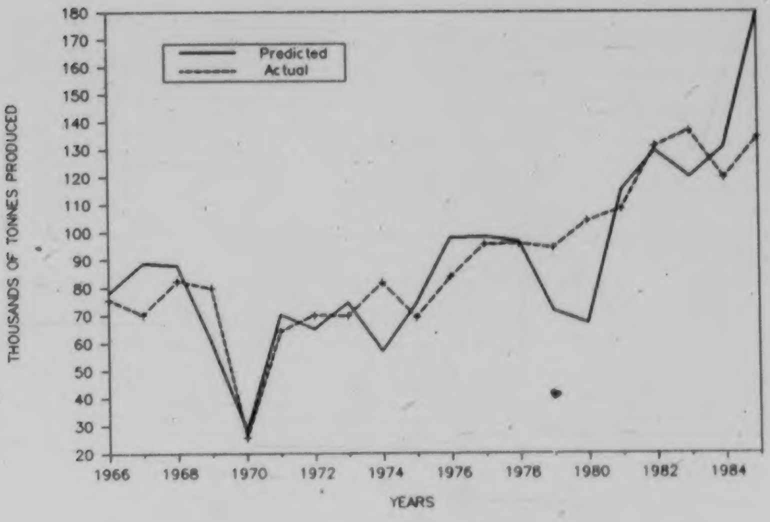


Figure A-11 Actual vs. Predicted Wheat Production - Manitoba

Table A-12 Barley Supply in Manitoba

Ordinary Least Squares Regression

Dependent Variable	MBP
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	17,439
Mean of Dependent Variable	69,286
Sum of Squared Residuals	-280.19
R-Squared	0.66
Adjusted R-Squared	0.61
Durbin Watson Statistic	1.89
Estimated Autocorrelation (Rho)	0.01
F-Statistic - From Mean	11.05
F - Statistic - From Zero	91.16

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REBB	28,614	11,438	2.50	0.59	4,555.4	52,489
RPRICCB	2,881.7	3,042.2	0.95	0.22	-3,450.4	9,313
DUM73	39,756	12,170	3.27	0.08	-	-
CONST.	7,558.4	11,457	0.66	0.11	-	-

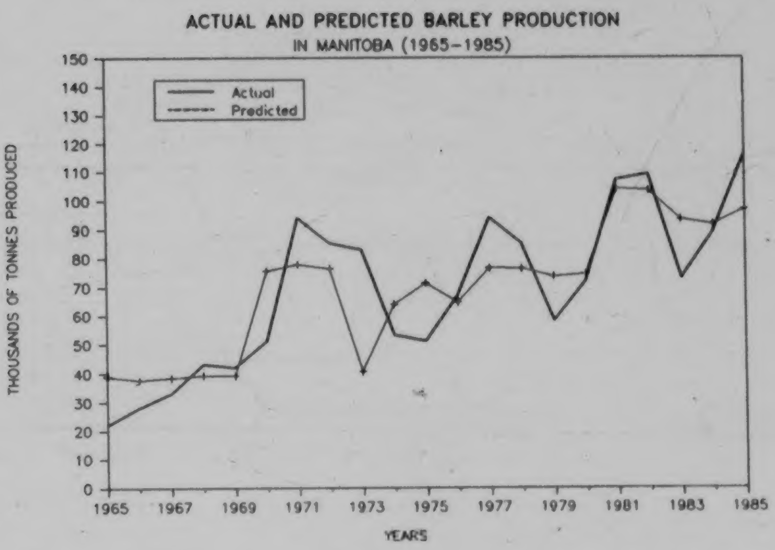


Figure A-12 Actual vs. Predicted Barley Production - Manitoba

Table A-13 Canola Supply in Saskatchewan 14

Ordinary Least Squares Regression

Dependent Variable	SCP14
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	341.11
Mean of Dependent Variable	682.55
Sum of Squared Residuals	4,913.20
R-Squared	0.76
Adjusted R-Squared	0.70
Durbin Watson Statistic	2.60
Estimated Autocorrelation (Rho)	0.31
F-Statistic - From Mean	-
F - Statistic - From Zero	-

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REWSR	- 253.62	91.23	2.78	0.94	-447.04	-60.21
RECSR	231.03	49.54	4.66	1.80	126.01	336.04
DUM78	514.63	217.62	2.36	0.07	-	-
DUML	1,263.3	159.34	7.92	0.35	-	-
CONST.	- 188.54	161.20	1.17	-	-	-

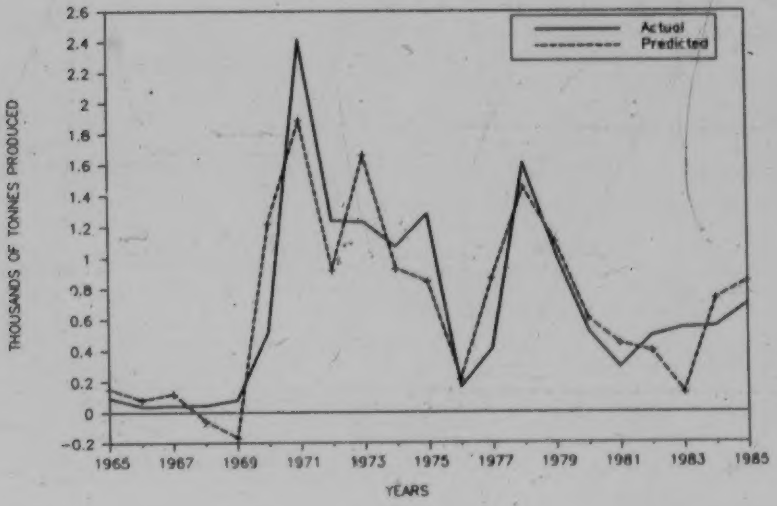


Figure A-13 Actual vs. Predicted Canola Production - Saskatchewan 14

Table A-14 Wheat Supply in Saskatchewan 14

Ordinary Least Squares Regression

Dependent Variable	SWP14
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	31,937
Mean of Dependent Variable	141,160
Sum of Squared Residuals	-20,148
R-Squared	0.39
Adjusted R-Squared	0.22
Durbin Watson Statistic	1.58
Estimated Autocorrelation (Rho)	0.12
F-Statistic - From Mean	
F - Statistic - From Zero	

					Confidence Internval 95 Percent	
Var.	Estimated Coefficient	Standard Error	T-Ratio	Mean Elasticity	Lower	Upper
REWSR	18,751	14,412	1.30	0.35	-11.962	49,464
RECSR	-10,386	6,624.3	1.57	0.40	-24,502	3,730
DUM70	-79,922	28,868	2.58	0.03	-	-
QUOTA	502.68	5,091.9	0.09	0.01	-10,348	11,354
CONST.	151,350	31,865	4.75		-	-

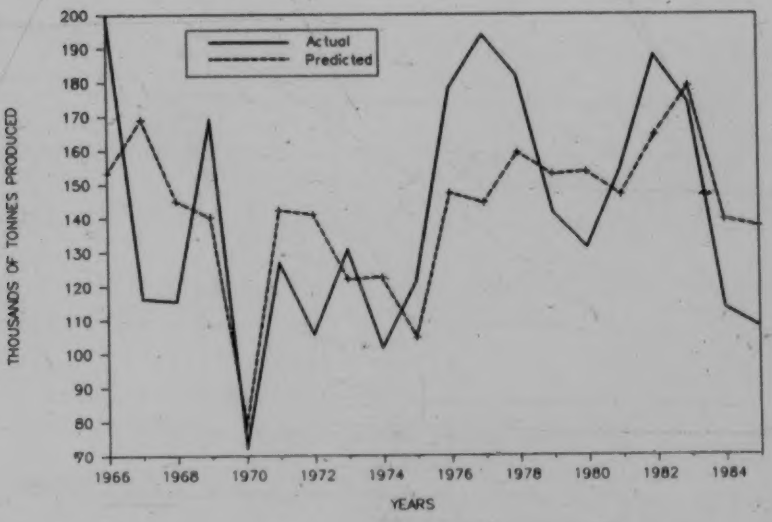


Figure A-14 Actual vs. Predicted Wheat Production - Saskatchewan 14

Table A-15 Barley Supply in Saskatchewan 14

Ordinary Least Squares Regression

Dependent Variable	SBP
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	8,480.8
Mean of Dependent Variable	27,517
Sum of Squared Residuals	-1,242.30
R-Squared	0.74
Adjusted R-Squared	0.70
Durbin Watson Statistic	2.17
Estimated Autocorrelation (Rho)	0.12
F-Statistic - From Mean	
F - Statistic - From Zero	

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REBSR	23,493	8,959.4	2.62	1.20	4,588.9	42,398
REWSR	- 11,180	4,447.3	2.51	1.03	-20,563	-1,795
DUMAL	36,620	4,293.3	8.53	0.25	-	-
CONST.	16,176	4,353.5	3.71		-	-

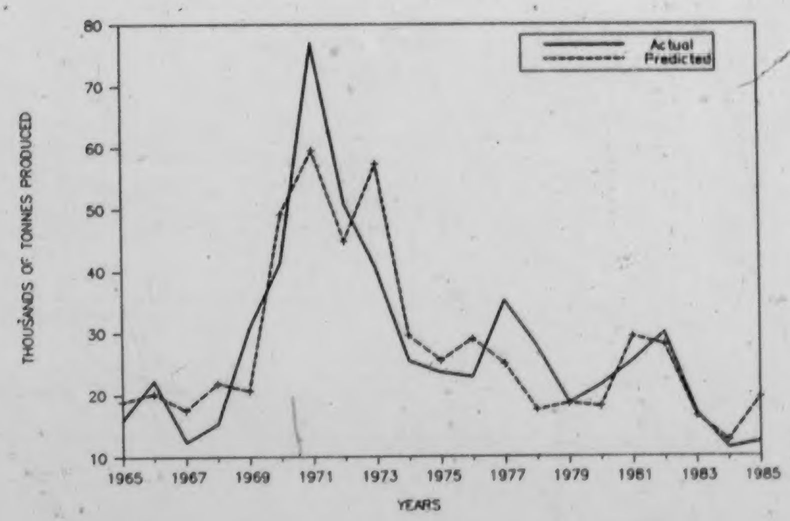


Figure A-15 Actual vs. Predicted Barley Production - Saskatchewan 14

Table A-16 Canola Supply in Saskatchewan 568

Ordinary Least Squares Regression

Dependent Variable	CPS568
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	5,743.9
Mean of Dependent Variable	19,467
Sum of Squared Residuals	536.79
R-Squared	0.76
Adjusted R-Squared	0.70
Durbin Watson Statistic	1.82
Estimated Autocorrelation (Rho)	0.002
F-Statistic - From Mean	-
F - Statistic - From Zero	-

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
RECSA	3,933.6	1,091.8	3.60	1.07	1,618.9	6,248
REBSA	-1,852.5	4,309.1	0.43	0.13	-10,988	7,282
DUML	12,212	4,429.8	2.76	0.12	-	-
DUM78	10,414	4,865.7	2.14	0.05	-	-
CONST.	-1,963.6	5,138.2	0.38	0.10	-	-

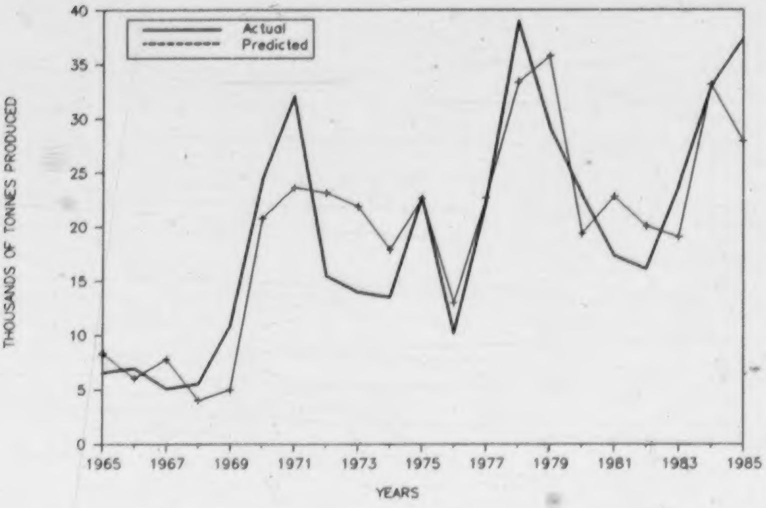


Figure A-16 Actual vs. Predicted Canola Production - Saskatchewan 568

Table A-17 Wheat Supply in Saskatchewan 568

Ordinary Least Squares Regression

Dependent Variable	WPS568
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	26,722
Mean of Dependent Variable	147,720
Sum of Squared Residuals	-12,963
R-Squared	0.70
Adjusted R-Squared	0.62
Durbin Watson Statistic	1.64
Estimated Autocorrelation (Rho)	0.11
F-Statistic - From Mean	
F - Statistic - From Zero	

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REWSA	40,982	11,372	3.60	0.72	16,747	65,216
RECSA	-16,007	5,458.4	2.93	0.59	-27,660	-4,353
DUM70	-85,731	26,009	3.30	-0.03	-	-
QUOTA	7,037.8	4,278.8	0.14	0.14	-2,080.2	16,156
CONST.	113,380	24,027	4.72	0.77	-	-

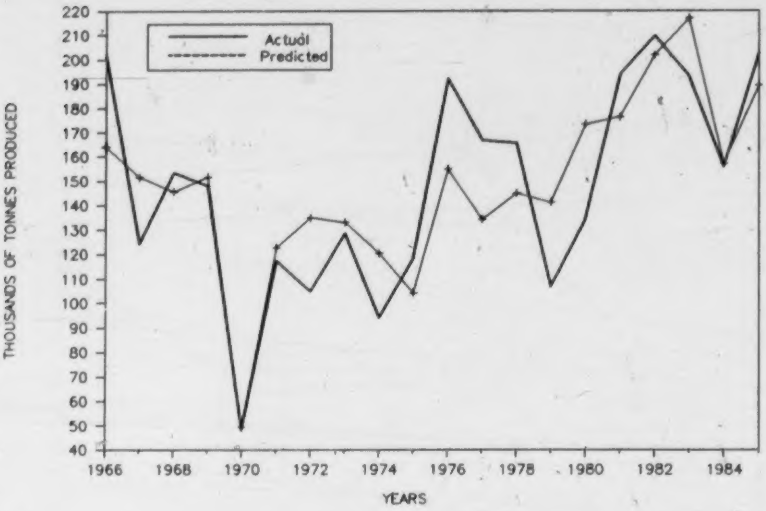


Figure A-17 Actual vs. Predicted Wheat Production - Saskatchewan 568

Table A-18 Barley Supply in Saskatchewan 568

Ordinary Least Squares Regression

Dependent Variable	BPS568
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	15,272
Mean of Dependent Variable	63,421
Sum of Squared Residuals	618,460
R-Squared	0.63
Adjusted R-Squared	0.56
Durbin Watson Statistic	1.42
Estimated Autocorrelation (Rho)	0.19
F-Statistic - From Mean	9.48
F - Statistic - From Zero	97.65

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REBSA	30,966	19,199	1.61	0.68	-9,544.3	71,477
REWSA	- 3,574.5	9,789.1	0.37	0.14	-21,230	17,081
DUM71a	50,580	10,581	4.78	0.11	-	-
CONST.	22,098	9,481.2	2.33	0.35	-	-

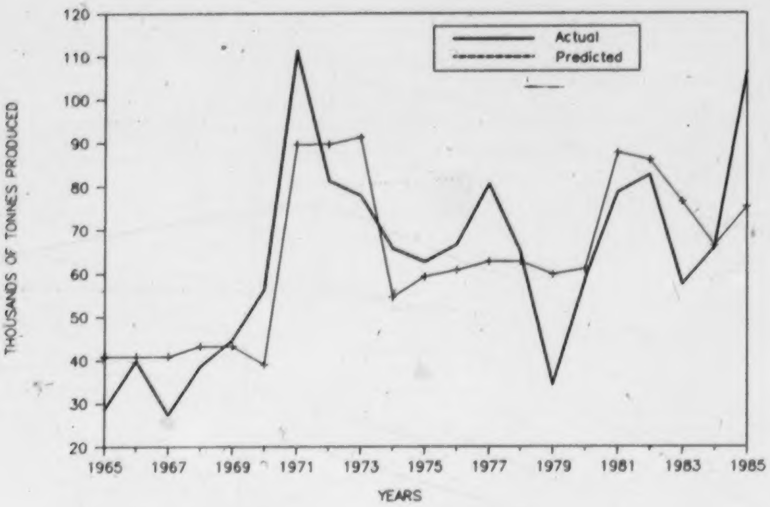


Figure A-18 Actual vs. Predicted Barley Production - Saskatchewan 568

Table A-19 Canola Supply in Saskatchewan 79

Ordinary Least Squares Regression

Dependent Variable	SCP79
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	3,414.0
Mean of Dependent Variable	14,441
Sum of Squared Residuals	8,970.1
R-Squared	0.86
Adjusted R-Squared	0.83
Durbin Watson Statistic	1.44
Estimated Autocorrelation (Rho)	0.07
F-Statistic - From Mean	-
F - Statistic - From Zero	-

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
RECS	2,140.6	595.04	3.60	0.66	835.03	3,396.1
REBS	-5695.6	2,793.1	2.03	0.55	-11,581	197.7
DUM78	2,140.5	595.04	2.60	0.79	-	-
CONST.	11,750	7,694.5	1.53	0.81	-	-

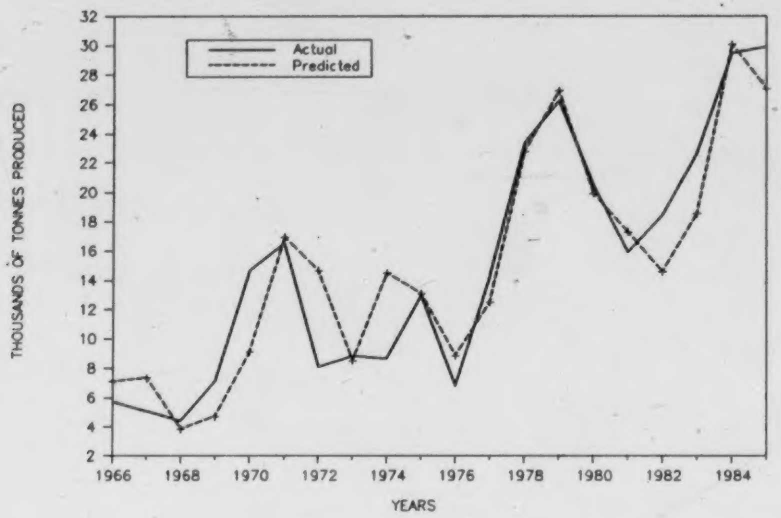


Figure A-19 Actual vs. Predicted Canola Production - Saskatchewan 79

Table A-20 Wheat Supply in Saskatchewan 79

Ordinary Least Squares Regression

Dependent Variable	SWP79
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	11,264
Mean of Dependent Variable	76,261
Sum of Squared Residuals	-11,104
R-Squared	0.79
Adjusted R-Squared	0.73
Durbin Watson Statistic	1.39
Estimated Autocorrelation (Rho)	0.13
F-Statistic - From Mean	-
F - Statistic - From Zero	-

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T-Ratio	Mean Elast.	Lower	Upper
						27,991
REWS	17,272	5,030.2	3.43	0.59	6,552.5	-1,586
RECS	-6,556.4	2,332.1	2.81	0.47	-11,526	-
DUM70	-36,968	10,616	3.48	-0.02	-	8,013
QUOTA	4,183.0	1,797.7	2.33	0.16	352.07	-
CONST.	57,567	10,982	5.24	0.75	-	

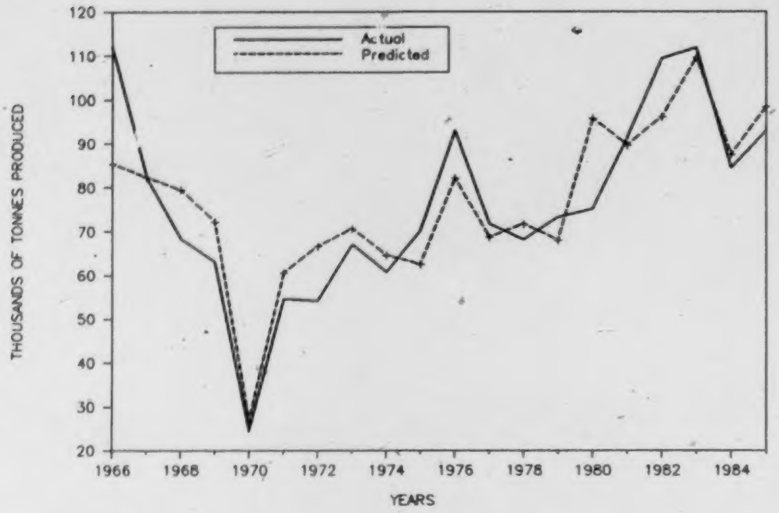


Figure A-20 Actual vs. Predicted Wheat Production - Saskatchewan 79

Table A-21 Barley Supply in Saskatchewan 79

Ordinary Least Squares Regression

Dependent Variable	SBP79
Number of Observations	21
Sample Perid	1965-1985
Standard Error of Regression	8,362.1
Mean of Dependent Variable	41,301
Sum of Squared Residuals	541,150
R-Squared	0.53
Adjusted R-Squared	0.41
Durbin Watson Statistic	1.48
Estimated Autocorrelation (Rho)	0.17
F-Statistic - From Mean	4.49
F - Statistic - From Zero	106.05

					Confidence Internval 95 Percent	
Var.	Est. Coeff.	Stand. Error	T Ratio	Mean Elast.	Lower	Upper
REBS	19,047	10,617	1.79	0.64	-3,461	41,554
REWS	- 8,440.4	5,568.2	1.51	0.52	-20,245	3,364.
DUM71	30,099	8,859.9	3.40	0.03	-	-
RECS	1,540.9	1,499.3	1.03	0.20	-1,637	4,719
CONST.	26,587	4,818.8	5.51	0.64		

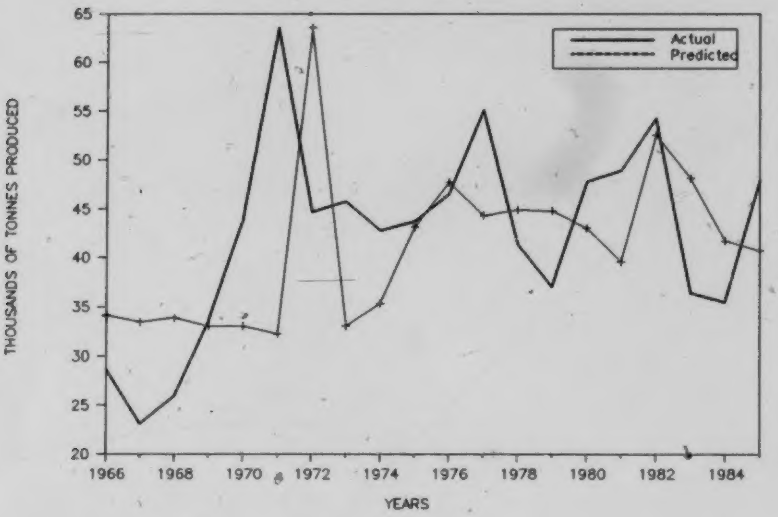


Figure A-21 Actual vs. Predicted Barley Production - Saskatchewan 79

TABLE A-22: CROP PRODUCTION UNDER THE BASELINE SCENARIO (1982-1987)

('000 TONNES)

	CROP YEAR					
Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123						
Barley	2021.07	1191.67	1366.76	1231.52	2340.59	971.42
Wheat	3022.02	2191.57	2504.52	1502.23	2551.99	1824.72
Canola	166.15	215.75	155.04	153.16	159.15	196.44
Alberta 456						
Barley	3156.66	2951.16	3163.76	3200.50	2512.10	2256.29
Wheat	2219.00	1653.38	1977.91	1494.53	1834.83	1402.15
Canola	620.71	769.00	503.27	760.82	587.69	718.89
Alberta 7						
Barley	786.17	624.45	755.33	799.94	626.64	49.83
Wheat	725.45	499.39	483.11	447.54	548.28	370.59
Canola	195.08	353.28	243.03	249.29	210.99	335.91
Saskatchewan 14						
Barley	360.18	274.64	424.85	556.17	291.78	234.97
Wheat	4892.06	3811.88	3754.43	3333.26	5554.87	4234.84
Canola	3.03	16.24	18.78	16.92	0.00	1.91
Saskatchewan 568						
Barley	1665.39	1444.94	1640.63	1682.79	1321.03	1098.14
Wheat	5932.99	4275.00	5163.69	4234.95	5505.42	3605.84
Canola	427.18	750.67	631.41	710.91	350.36	633.37
Saskatchewan 79						
Barley	908.34	883.98	976.73	1040.52	791.77	744.80
Wheat	2991.18	2372.88	2675.23	2018.46	2958.30	2122.74
Canola	420.34	674.94	567.50	658.58	534.78	778.25
Manitoba						
Barley	2035.13	1998.83	2109.65	2140.74	1489.94	1382.57
Wheat	3713.65	3250.63	3656.84	3762.98	3713.06	3200.33
Canola	416.48	540.88	473.96	565.83	393.37	574.68
Total	36678.3	30745.2	29956.4	27211.1	34276.9	26738.7

TABLE A-23: PERCENT ERROR IN ESTIMATED PRODUCTION (1982-1987)

PERCENT

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123						
Barley	11.19	26.49	22.05	(100.34)	39.50	(61.48)
Wheat	(2.90)	17.32	21.75	(124.43)	25.43	(40.58)
Canola	1.15	20.23	(0.85)	(58.49)	(23.89)	(8.81)
Alberta 456						
Barley	19.50	(2.66)	2.04	(24.47)	(34.22)	(54.80)
Wheat	3.75	(13.65)	5.26	(59.52)	(11.40)	(49.07)
Canola	(27.53)	(15.10)	(10.98)	(38.40)	(57.75)	(30.17)
Alberta 7						
Barley	(0.52)	(17.18)	20.10	(24.39)	(23.01)	1.01
Wheat	(19.25)	(37.84)	3.32	(31.01)	(13.99)	(60.44)
Canola	(27.53)	14.08	0.05	(44.41)	(42.62)	9.05
Saskatchewan 14						
Barley	(3.25)	9.49	36.65	(20.85)	(30.41)	(78.44)
Wheat	3.36	19.02	21.87	(83.32)	5.69	(11.34)
Canola	(305.84)	23.34	15.80	(76.11)	438.86	(1187.7)
Saskatchewan 568						
Barley	24.81	0.47	(41.55)	(26.58)	(47.46)	(59.12)
Wheat	11.53	1.06	(6.72)	(31.42)	28.99	(37.68)
Canola	26.29	0.35	(34.42)	(11.46)	(129.53)	(24.62)
Saskatchewan 79						
Barley	12.73	12.50	(6.94)	(15.71)	(26.85)	(43.46)
Wheat	(1.70)	3.43	5.62	(65.88)	8.36	(33.22)
Canola	(22.19)	0.97	(19.43)	(2.46)	(26.87)	9.66
Manitoba						
Barley	21.90	3.06	(19.72)	(17.98)	(49.58)	(61.20)
Wheat	12.05	(9.27)	(33.98)	(30.20)	(12.24)	(34.99)
Canola	4.70	(0.64)	(33.99)	(12.24)	(51.47)	(9.75)

TABLE A-24: C.W.B COSTS FROM GRAIN SHIPMENTS (1982-1987)

CURRENT CONDITIONS AS WEST COAST CAPACITY ('000 $)

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123						
Barley	-	-	-	-	-	-
Wheat	59,896	43,656	58,606	39,223	-	-
Oats	100	140	60	134	187	205
Alberta 456						
Barley	-	-	-	-	-	-
Wheat	44,824	19,972	47,272	39,620	-	-
Oats	1,905	2,522	2,570	2,183	2,985	3,269
Alberta 7						
Barley	-	-	-	-	-	-
Wheat	-	-	-	-	-	-
Oats	419	802	680	365	702	768
Saskatchewan 14						
Barley	423	453	9,914	957	319	227
Wheat	93,438	75,780	82,598	83,398	126,596	106,168
Oats	185	149	48	124	186	203
Saskatchewan 568						
Barley	691	888	1,558	1,254	833	698
Wheat	113,320	84,987	113,601	105,958	125,468	90,398
Oats	306.00	687	417	646	656	722
Saskatchewan 79						
Barley	-	-	2,695	-	-	-
Wheat	57,132	47,410	59,176	50,684	50,226	12,547
Oats	248	424	148	128	315	346
Manitoba						
Barley	19,283	4,607	36,608	10,995	3,081	2,884
Wheat	70,931	64,622	80,451	94,150	84,621	80,232
Oats	717	728	865	1,194	1,083	1,190
Total	463,818	347,828	497,265	431,013	397,258	299,857

TABLE A-25: C.W.B COSTS FROM GRAIN SHIPMENTS (1982-1987)

INCREASED WEST COAST CAPACITY ('000 $)

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123						
Barley	-	-	-	-	-	-
Wheat	-	-	-	-	-	-
Oats	100	140	60	134	187	205
Alberta 456						
Barley	-	-	-	-	-	-
Wheat	-	-	-	-	-	-
Oats	1,905	2,522	2,570	2,183	2,985	3,269
Alberta 7						
Barley	-	-	-	-	-	-
Wheat	-	-	-	-	-	-
Oats	419	802	680	365	702	768
Saskatchewan 14						
Barley	423	453	908	957	319	227
Wheat	93,438	75,780	82,598	83,398	126,596	48,492
Oats	185	149	48	124	186	203
Saskatchewan 568						
Barley	691	888	1,558	1,254	833	698
Wheat	113,320	32,082	64,110	39,174	79,142	3,029
Oats	306	687	417	32	656	722
Saskatchewan 79						
Barley	-	-	-	-	-	-
Wheat	4,818	-	-	-	-	-
Oats	248	424	148	128	315	346
Manitoba						
Barley	4,659	4,607	36,608	5,888	3,081	2,884
Wheat	70,931	64,622	80,451	94,150	84,621	80,232
Oats	717	728	865	1,194	1,083	1,190
Total	292,160	183,885	271,018	228,981	300,705	142,266

APPENDIX B

Adjusted Shipping Costs to the C.W.B
Under A-1 and A-2 Cost Savings

TABLE B-1: C.W.B FREIGHT COSTS UNDER SCENARIO A-1 (1982-1987)

CURRENT CONDITIONS AS WEST COAST CAPACITY ('000 $)

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123						
Barley	-	-	-	-	-	-
Wheat	60,198	43,965	58,981	39,539	-	-
Oats	100	140	60	134	187	205
Alberta 456						
Barley	-	-	-	-	-	-
Wheat	45,099	34,513	47,861	33,049	-	-
Oats	1,905	2,522	2,570	2,183	2,985	3,269
Alberta 7						
Barley	-	-	-	-	-	-
Wheat	-	-	-	12,785	-	-
Oats	419	802	680	365	702	768
Saskatchewan 14						
Barley	7,473	587	9,622	940	293	194
Wheat	92,780	75,546	82,380	83,256	126,378	106,028
Oats	185	149	48	124	186	203
Saskatchewan 568						
Barley	693	1,098	1,562	1,257	830	696
Wheat	113,716	85,300	113,901	106,339	125,656	90,856
Oats	306	687	417	646	656	722
Saskatchewan 79						
Barley	-	-	4,423	-	-	-
Wheat	57,381	47,692	59,507	50,980	50.030	12,987
Oats	248	424	148	128	315	346
Manitoba						
Barley	12,719	38,027	35,256	5,724	2,897	2,674
Wheat	70,561	64,197	79,252	93,683	83,975	79,521
Oats	717	728	865	1,194	1,083	1,190
Total	464,500	396,380	497,530	432,330	802,700	603,920

TABLE B-2: C.W.B FREIGHT COSTS UNDER SCENARIO A-2 (1982-1987)

CURRENT CONDITIONS AS WEST COAST CAPACITY ('000 $)

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123						
Barley	-	-	-	-	-	-
Wheat	62,199	45,713	61,170	40,602	-	-
Oats	100	140	60	134	187	205
Alberta 456						
Barley	-	-	-	-	-	-
Wheat	46,919	37,023	51,245	31,924	-	-
Oats	1,905	2,522	2,570	2,183	2,985	3,269
Alberta 7						
Barley	-	-	-	-	-	-
Wheat	-	-	-	14,160	-	-
Oats	419	802	680	365	702	768
Saskatchewan 14						
Barley	6,802	424	7,498	806	204	115
Wheat	94,753	75,546	84,422	84,373	126,611	106,897
Oats	185	149	48	124	186	203
Saskatchewan 568						
Barley	696	1,083	1,559	1,248	823	689
Wheat	117,636	89,402	118,915	109.712	126,658	93,042
Oats	306	687	417	646	656	722
Saskatchewan 79						
Barley	-	-	5,557	-	-	-
Wheat	59,033	49,303	61,442	52,071	49,841	14,664
Oats	248	424	148	128	315	346
Manitoba						
Barley	14,687	35,646	35,722	5,744	2,897	2,673
Wheat	72,931	66,517	82,204	95,284	84,368	80,718
Oats	717	728	865	1,194	1,083	1,190
Total	479,360	406,110	514,520	440,500	397,520	305,500

APPENDIX C

Adjusted Freight Costs to the C.W.B

from Grain Shipments under B-1 Savings

TABLE C-1: C.W.B FREIGHT COSTS UNDER SCENARIO B-1 (1983-1987)

CURRENT CONDITIONS AS WEST COAST CAPACITY ('000 $)

Crop	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123					
Barley	-	-	-	-	-
Wheat	-	46,071	1,169	-	-
Oats	140	55	126	176	193
Alberta 456					
Barley	-	-	-	-	-
Wheat	-	-	-	-	-
Oats	2,399	2,289	1,997	2,740	3,011
Alberta 7					
Barley	-	-	-	-	-
Wheat	-	-	35,941	-	-
Oats	697	545	309	598	657
Saskatchewan 14					
Barley	-	-	-	-	-
Wheat	108,245	85,624	87,910	124,089	109,385
Oats	192	61	161	245	261
Saskatchewan 568					
Barley	17,674	32,638	-	-	-
Wheat	97,805	119,779	116,223	112,121	64,623
Oats	687	417	646	656	722
Saskatchewan 79					
Barley	-	16,323	-	-	-
Wheat	-	139,705	54,881	-	-
Oats	421	147	127	313	344
Manitoba					
Barley	567	24,383	8,621	1,645	404
Wheat	61,624	74,391	89,767	70,644	72,239
Oats	728	865	1,194	1,083	1,190
Total	291,180	543,290	399,070	314,310	253,030

APPENDIX D

Adjusted Freight Costs to the C.W.B

from Grain Shipments under B-2 SAVINGS

TABLE D-1: C.W.B FREIGHT COSTS UNDER SCENARIO B-2 (1983-1987)

CURRENT CONDITIONS AS WEST COAST CAPACITY ('000 $)

Crop	1983/84	1984/85	1985/86	1986/87	1987/88
Alberta 123					
Barley	-	-	-	-	-
Wheat	-	40,432	20,376	-	-
Oats	140	55	126	176	193
Alberta 456					
Barley	-	-	-	-	-
Wheat	-	-	36,409	-	-
Oats	2,399	2,289	1,997	2,740	3,011
Alberta 7					
Barley	-	-	-	-	-
Wheat	-	-	-	-	-
Oats	-	545	309	598	657
Saskatchewan 14					
Barley	2,043	6,219	-	-	-
Wheat	74,111	83,354	82,048	124,707	103,667
Oats	192	61	161	245	261
Saskatchewan 568					
Barley	17,674	-	-	-	-
Wheat	81,168	113,709	102,354	120,413	44,333
Oats	687	417	646	656	722
Saskatchewan 79					
Barley	-	19,591	-	-	-
Wheat	106,348	134,671	49,399	-	-
Oats	421	147	127	313	344
Manitoba					
Barley	20,855	26,281	10,552	2,656	1,510
Wheat	57,497	71,212	81,838	71,212	64,583
Oats	728	865	1,194	1,083	1,190
Total	258,600	499,840	387,540	324,800	220,470

APPENDIX E

C.W.B. Freight Costs from Grain Shipments
Under each Cost Comparison
with the Mississippi River Alternative

TABLE E-1: C.W.B FREIGHT COSTS UNDER SCENARIOS C-1 TO C-4 (1985-1986)

CURRENT CONDITIONS AS WEST COAST CAPACITY ('000 $)

Crop	C-1	C-2	C-3	C-4
Alberta 123				
Barley	-	-	-	-
Wheat	-	-	-	-
Oats	-	-	-	-
Alberta 456				
Barley	-	-	-	-
Wheat	-	-	-	-
Oats	-	-	2,865	2,865
Alberta 7				
Barley	-	-	-	-
Wheat	-	-	-	-
Oats	-	-	-	-
Saskatchewan 14				
Barley	5,159	4,752	5,600	478
Wheat	49,803	38,842	49,993	56,713
Oats	-	-	-	-
Saskatchewan 568				
Barley	26,610	-	27,501	22,783
Wheat	82,215	-	82,764	102,279
Oats	496	-	496	496
Saskatchewan 79				
Barley	-	-	-	-
Wheat	22,157	-	25,661	48,224
Oats	131	-	131	131
Manitoba				
Barley	4,363	4,510	4,557	3,855
Wheat	14,936	15,609	15,011	17,683
Oats	-	-	-	-
Total	205,870	64,209	214,579	255,508

APPENDIX F

Marginal and Post Optimal Analysis

A. Marginal Analysis

The marginal costs of alternative allocations of grain shipments on a sub regional basis are illustrated in Table F-1.[39] By introducing a tonne of wheat and barley through West Coast ports, it is estimated that system rail transport costs would increase between a low of $4.18 per tonne respectively in Saskatchewan's sub-region 568 to a high of $19.73 per tonne for wheat in Manitoba and $31.76/tonne in Saskatchewan's sub-region 14, under constrained West Coast shipments. Relaxing the export constraint at West Coast ports alleviates these added costs of allocating additional grain shipments through these ports. However, in Alberta, it would be very costly to the western Canadian grains economy if additional shipments of wheat and barley are allocated through the St. Lawrence Seaway and the Mississippi River System (approximately $4.69 to $23.09 per tonne) given this provinces locational advantage to West Coast ports. Shipments allocated to the St. Lawrence and Mississippi ports, therefore, would originate from sub-regions 14 and 568 in Saskatchewan and in Manitoba if the C.W.B. was to maintain their objective of selling grain for reasonable prices in order to promote

---

39 These values represent the costs of alternative grain exchanges necessary to satisfy all constraints when introducing an additional tonne of grain either through the West Coast, the Mississippi River system, and Vancouver and/or Prince Rupert ports, that are at a zero level in the least cost grain shipment solution. These reduced costs can also be interpreted as the amount by which the costs of grain shipments through the export ports from a particular region would have to be reduced to enable the introduction of that particular activity (port shipments) to break-even. (I.B.M., 1964)

TABLE F-1: MARGINAL COSTS OF ALTERNATIVE ALLOCATIONS OF GRAIN SHIPMENTS UNDER THE MISSISSIPPI RIVER ALTERNATIVE (1985-1986)

$/Tonne

REGION	WHEAT	BARLEY	OATS	AVERAGE
ACTUAL PRODUCTION AND MARKETING CONDITIONS				
WEST COAST				
ALBERTA				
123	-	-	3.25	1.08
456	-	-	1.39	0.46
7	-	-	-	-
SASKATCHEWAN				
14	9.15	31.76	17.00	19.30
568	4.18	4.18	12.03	6.80
79	-	-	7.87	2.62
MANITOBA	19.73	19.73	27.58	22.35
AVERAGE	11.02	18.54	11.52	11.75
MISSISSIPPI				
ALBERTA				
123	4.60	4.60	7.85	5.68
456	6.46	6.46	7.85	6.92
7	13.05	13.05	13.05	13.05
SASKATCHEWAN				
14	-	-	7.85	2.62
568	-	-	7.85	2.62
79	-	-	7.87	2.62
MANITOBA	-	-	7.85	2.62
AVERAGE	8.04	8.04	8.60	8.33
EAST COAST				
ALBERTA				
123	5.82	6.43	-	4.08
456	7.68	13.94	-	7.21
7	14.27	20.53	5.20	13.33
SASKATCHEWAN				
14	1.22	7.48	-	2.90
568	1.22	1.22	-	0.81
79	1.20	7.46	-	2.89
MANITOBA	1.22	7.48	-	2.90
AVERAGE	4.66	9.22	5.20	6.82

...Continued

the sale of western Canadian grain in international markets.[40] Hence, additional throughput of grain at West Coast ports would originate also from Saskatchewan's sub-regions 14 and 568, and in Manitoba, since all available exports from Alberta and Saskatchewan's sub-region 79 are estimated to be shipped through Vancouver and/or Prince Rupert ports.

---

[40] C.W.B. Act, October 19, 1987, pp. 4.

TABLE F-1: *con't* **MARGINAL COSTS OF ALTERNATIVE ALLOCATIONS OF GRAIN SHIPMENTS UNDER THE MISSISSIPPI RIVER ALTERNATIVE, (1985-1986)**

$/Tonnes

REGION	WHEAT	BARLEY	OATS	AVERAGE
ESTIMATED WEST COAST CAPACITY BY THE C.W.B.				
WEST COAST				
ALBERTA				
123	-	-	-	-
456	-	-	-	-
7	-	-	-	-
SASKATCHEWAN				
14	-	22.61	7.85	10.15
568	-	-	2.88	0.96
79	-	-	-	-
MANITOBA	10.58	10.58	18.43	13.20
AVERAGE	10.58	16.60	9.72	12.15
MISSISSIPPI				
ALBERTA				
123	13.75	13.75	13.75	13.75
456	15.61	15.61	15.61	15.61
7	22.20	22.20	22.20	22.20
SASKATCHEWAN				
14	-	-	7.85	2.62
568	4.97	4.97	7.85	5.93
79	9.15	9.15	9.15	9.15
MANITOBA	-	-	7.85	2.61
AVERAGE	13.14	13.14	12.04	12.68
EAST COAST				
ALBERTA				
123	14.97	15.58	5.90	12.15
456	16.83	23.09	7.76	15.89
7	23.42	29.68	14.35	22.48
SASKATCHEWAN				
14	1.22	7.48	-	2.90
568	6.19	6.19	-	4.13
79	10.35	16.61	1.28	9.41
MANITOBA	1.22	7.48	-	2.90
AVERAGE	10.60	15.16	7.32	11.51

B. Post - Optimal Analysis

Analyzing the initial optimal solution of the linear programming model is defined as post - optimal analysis. This involves conducting sensitivity analysis (range analysis) to evaluate estimates of model parameters. The purpose of sensitivity analysis is two fold. First, to determine the input parameters that are the most crucial in determining the optimal solution. Second, to seek an adequate solution over the entire range of likely values, given a set of critical parameters. Post - optimal analysis also involves obtaining a sequence of solutions to evaluate trade-offs between model parameters (parametric programming), under a particular course of action. This section will focus on range analysis, and parametric programming in order to determine the sensitivity of the parameters included in the grain re-distribution model and to evaluate any trade-offs between parameter values through parametric programming.

C. Range Analysis

Tables F-2 and F-4 illustrate the ranges of both basic activities and the right hand side values found in the optimal solution.

TABLE F-2: RANGES OF BASIC ACTIVITIES OVER WHICH THE OBJECTIVE FUNCTION REMAINS OPTIMAL (1985-1986)

ST. LAWRENCE AND/OR THUNDER BAY/VANCOUVER PRICING

Dollars per Tonne

	12 Million Tonne West Coast Constraint			20 Million Tonne West Coast Constraint		
VARIABLE	SOL. VALUE	LOWER LIMIT	UPPER LIMIT	SOL. VALUE	LOWER LIMIT	UPPER LIMIT
W79WC	29.42	29.42	29.42	29.42	−∞	38.57
OMTB	37.51	−∞	37.51	37.51	−∞	45.36
W79MIS	53.70	53.70	53.70	-	-	-
B123WC	27.11	−∞	27.11	27.11	−∞	40.86
B456WC	26.18	−∞	26.18	26.18	−∞	41.79
B7WC	29.42	−∞	29.42	29.42	−∞	51.62
W14MIS	49.52	−∞	49.52	49.52	46.64	50.74
BMMIS	45.36	−∞	45.36	45.36	−∞	52.84
W7WC	29.42	−∞	29.42	29.42	−∞	51.62
W123WC	27.11	−∞	27.11	27.11	−∞	40.86
B79WC	29.42	−∞	29.42	29.42	−∞	38.57
C456WC	26.18	−∞	26.18	26.18	−∞	+∞
W568MIS	51.37	−∞	51.37	-	-	-
C123WC	27.11	−∞	27.11	27.11	−∞	+∞
CMWC	40.81	−∞	40.81	40.81	−∞	+∞
C14WC	34.39	−∞	34.39	34.39	−∞	+∞
C79WC	29.42	−∞	29.42	29.42	−∞	+∞
C568WC	31.27	−∞	31.27	31.27	−∞	+∞
O568TB	43.52	−∞	43.52	43.52	−∞	46.40
B568MIS	51.37	−∞	51.37	-	-	-
C7WC	29.42	−∞	29.42	29.42	−∞	+∞

...Continued

TABLE F-2: ***con't*** **RANGES OF BASIC ACTIVITIES OVER WHICH THE OBJECTIVE FUNCTION REMAINS OPTIMAL (1985-1986)**

ST. LAWRENCE AND/OR THUNDER BAY/VANCOUVER PRICING

Dollars per Tonne

	12 Million Tonne West Coast Constraint			20 Million Tonne West Coast Constraint		
VARIABLE	SOL. VALUE	LOWER LIMIT	UPPER LIMIT	SOL. VALUE	LOWER LIMIT	UPPER LIMIT
WMMIS	45.36	$-\infty$	45.36	45.36	$-\infty$	46.58
O456TB	49.07	$-\infty$	49.07	-	-	-
O7WC	29.42	$-\infty$	29.42	29.42	$-\infty$	43.77
O123TB	48.14	$-\infty$	48.14	-	-	-
W456WC	26.18	$-\infty$	26.18	26.18	$-\infty$	41.79
O14TB	41.67	$-\infty$	41.67	41.67	$-\infty$	49.52
O79TB	45.83	$-\infty$	45.83	-	-	-
B14MIS	49.52	$-\infty$	49.52	49.52	$-\infty$	57.00
B568WC	-	-	-	31.27	$-\infty$	36.24
W14WC	-	-	-	34.39	33.11	37.27
W568WC	-	-	-	31.27	$-\infty$	36.24
O456WC	-	-	-	26.18	$-\infty$	33.94
O123WC	-	-	-	27.11	$-\infty$	33.01
O79WC	-	-	-	29.42	$-\infty$	30.70

This analysis gives the upper and lower bounds for each objective function coefficient (C(j)) and right hand side values (b(i)). These values represent the range by which each coefficient in the grain re-distribution model may be varied, between the upper and lower bounds, without altering the optimal solution. One should note that these upper and lower bounds results from varying only one variable at a time, *ceteris paribus*. By changing coefficients simultaneously may in fact result in a new optimal solution even though changes in each coefficient falls within the upper and lower bounds.

Analysis found in Table F-2 gives the range of variation for shipment costs from each sub-region in western Canada. Overall, the results indicate that under a 12 million tonne West Coast constraint total shipment allocations to the various ports would remain optimum if shipment costs varied any where between zero and the upper bound (solution value). If, however, the shipment costs were greater than the upper bounds, the basis would change. For example, if total costs to ship barley down the Mississippi River were increased from $51.37/tonne (upper bound or solution value) to $52.92/tonne (3 percent increase) for producers located in Saskatchewan's sub-region 568, total barley shipments would be diverted away from the Mississippi River system to the St. Lawrence seaway for this sub-region (Table F-2). This illustrates that the objective function coefficients are sensitive to increases and not sensitive to cost decreases in grain shipping costs under a 12 million tonne west coast constraint. An exception involves wheat shipping costs in Saskatchewan's

TABLE F-3: VARIABLE DEFINITIONS OF OBJECTIVE FUNCTION RANGES (BASIC ACTIVITIES)

VARIABLE	DESCRIPTION
W79WC	Saskatchewan 79 - wheat through the West Coast.
OMTB	Manitoba - oats through Thunder Bay.
W79MIS	Saskatchewan 79 - wheat at the Mississippi.
B123WC	Alberta 123 - barley through the West Coast.
B456WC	Alberta 456 - barley through the West Coast.
B7WC	Alberta 7 - barley through the West Coast.
W14MIS	Saskatchewan 14 - wheat at the Mississippi.
BMMIS	Manitoba - barley through the Mississippi.
W7WC	Alberta 7 - wheat through the West Coast.
W123WC	Alberta 123 - wheat through the West Coast.
B79WC	Saskatchewan 79 - barley at the West Coast.
C456WC	Alberta 456 - canola through the West Coast.
W568MIS	Saskatchewan 568 - wheat at the Mississippi.
C123WC	Alberta 123 - canola through the West Coast.
CMWC	Manitoba - canola through the West Coast.
C14WC	Saskatchewan 14 - canola at the West Coast.
C79WC	Saskatchewan 79 - canola at the West Coast.
C568WC	Saskatchewan 568 - canola at the West Coast.
O568TB	Saskatchewan 568 - oats at Thunder Bay.
B568MIS	Saskatchewan 568 - barley at the Mississippi.
C7WC	Alberta 7 - canola through the West Coast.
WMMIS	Manitoba - wheat through the Mississippi.
O456TB	Alberta 456 - oats through Thunder Bay.
O7WC	Alberta 7 - oats through the West Coast.
O123TB	Alberta 123 - oats through Thunder Bay.
W456WC	Alberta 456 - wheat through the West Coast.
O14TB	Saskatchewan 14 - oats at Thunder Bay.
O79TB	Saskatchewan 79 - oats at Thunder Bay.
B14MIS	Saskatchewan 14 - barley at the Mississippi.
B568WC	Saskatchewan 568 - barley at the West Coast.
W14WC	Saskatchewan 14 - wheat at the West Coast.
W568WC	Saskatchewan 568 - wheat at the West Coast.
O456WC	Saskatchewan 456 - oats at the West Coast.
O123WC	Alberta 123 - oats through the West Coast.
O79WC	Saskatchewan 79 - oats at the West Coast.

sub-region 79 through the West Coast and down the Mississippi River where both cost increases and declines will create a change in the initial basis. Relaxing West Coast capacity levels to 20 million tonnes, on the other hand, causes shipping costs to become less sensitive to freight cost changes. Although wheat shipping costs in Saskatchewan's sub-region 14 through the West Coast and down the Mississippi River become sensitive to both cost increases and decreases, but not to the magnitude found in sub-region 79 under a 12 million tonne West Coast constraint.

It is estimated that the direction in which grain is shipped from each sub-region in western Canada to the export ports is not sensitive to any change in the volume of grain shipped, given the right hand side ranges in Table F-4. Definition of the right hand side variables are in Table F-5.

This analysis gives the upper and lower bounds for each objective function coefficient (C(j)) and right hand side values (b(i)). These values represent the range by which each coefficient in the grain re-distribution model may be varied, between the upper and lower bounds, without altering the optimal solution. One should note that these upper and lower bounds results from varying only one variable at a time, *ceteris paribus*. By changing coefficients simultaneously may in fact result in a new optimal solution even though changes in each coefficient falls within the upper and lower bounds.

TABLE F-4: RIGHT HAND SIDE RANGES OVER WHICH THE OBJECTIVE FUNCTION REMAINS OPTIMAL UNDER THE MISSISSIPPI ALTERNATIVE (1985-1986)

12 MILLION TONNE CONSTRAINT

Thousands of Dollars

	St. Lawrence/Vancouver/Mississippi Pricing		
VARIABLE	SOL. VALUE	LOWER LIMIT	UPPER LIMIT
OA456W	1304.7	1010.0	2893.9
OA7W	339.6	44.95	1928.8
OA123W	1384.2	1089.5	2973.4
OMW	3139.6	0.00	+∞
OA456B	211.2	1822.6	3706.5
OA7B	613.2	318.58	2202.5
OA123B	765.2	470.58	2354.5
OMB	892.3	0.00	+∞
OS14B	338.0	0.00	+∞
OS568B	1268.4	0.00	+∞
OS79B	814.0	519.37	2403.3
OA456C	713.9	419.32	2303.2
OA7C	262.2	0.00	1851.4
OA123C	154.7	0.00	1743.9
OMC	543.32	248.67	2132.6
OS14C	18.8	0.00	1608.1
OS79C	669.1	374.51	2258.4
OS568C	690.8	396.20	2280.1
OS14W	3183.4	0.00	+∞
OS568W	3853.7	0.00	+∞
OS79W	1883.9	1589.2	+∞
OA456O	125.1	0.00	+∞
OA7O	19.3	0.00	1608.6
OA123O	7.8	0.00	+∞
OMO	74.8	0.00	+∞
OS14O	7.1	0.00	+∞
OS568O	40.4	0.00	+∞
OS79O	7.9	0.00	+∞
DEMWC	12000	10410.	12294.
DEMTB	+∞	−∞	263.5
DEMMIS	+∞	−∞	12970.

...Continued

TABLE F-4: *Con't* RIGHT HAND SIDE RANGES OVER WHICH THE OBJECTIVE FUNCTION REMAINS OPTIMAL UNDER THE MISSISSIPPI ALTERNATIVE (1985-1986)

12 MILLION TONNE CONSTRAINT

Thousands of Dollars

Thunder Bay/Vancouver/Mississippi Pricing

VARIABLE	SOL. VALUE	LOWER LIMIT	UPPER LIMIT
OA456W	1304.	1009.8	2893.76
OA7W	339.6	44.7	1928.66
OA123W	1384.	1089.3	2973.26
OMW	3595.	0.00	+∞
OA456B	2117.	1822.4	3706.35
OA7B	613.	318.3	2202.30
OA123B	765.2	470.3	2354.30
OMB	1153.	0.00	+∞
OS14B	392.1	0.00	+∞
OS568B	1314.	0.00	+∞
OS79B	814.0	519.1	2403.08
OA456C	713.9	419.1	2303.03
OA7C	262.2	0.00	1851.27
OA123C	154.7	0.00	1743.77
OMC	547.4	252.6	2136.54
OS14C	17.3	0.00	1606.39
OS79C	669.1	374.3	2258.23
OS568C	688.4	393.5	2277.47
OS14W	3278.	0.00	+∞
OS568W	3943.	0.00	+∞
OS79W	1883.	1589.0	+∞
OA456O	125.1	0.00	+∞
OA7O	19.3	0.00	1608.45
OA123O	7.8	0.00	+∞
OMO	74.8	0.00	+∞
OS14O	7.1	0.00	+∞
OS568O	40.4	0.00	+∞
OS79O	7.9	0.00	+∞
DEMWC	12000	10410.	12294.87
DEMTB	+∞	−∞	263.55
DEMMIS	+∞	−∞	13972.86

...Continued

TABLE F-4: *con't* **RIGHT HAND SIDE RANGES OVER WHICH THE OBJECTIVE FUNCTION REMAINS OPTIMAL UNDER THE MISSISSIPPI ALTERNATIVE, (1985-1986)**

20 MILLION TONNE CONSTRAINT

Thousands of Dollars

	St. Lawrence/Van./ Mississippi Pricing			Thunder Bay/Vancouver/ Mississippi Pricing		
VARIABLE	SOL. VALUE	LOWER LIMIT	UPPER LIMIT	SOL. VALUE	LOWER LIMIT	UPPER LIMIT
OA456W	1304.7	563.4	3746.8	1304.7	331.6	3610.0
OA7W	339.6	0.00	2781.7	339.6	0.00	2644.9
OA123W	1384.2	642.9	3826.3	1384.2	411.1	3689.5
OMW	3139.6	0.00	+∞	3595.2	0.00	+∞
OA456B	2117.3	1376.0	4559.4	2117.2	1144.2	4422.6
OA7B	613.2	0.00	3055.4	613.2	0.00	2918.5
OA123B	765.2	23.9	3207.4	765.2	0.00	3070.5
OMB	892.4	0.00	+∞	1153.5	0.00	+∞
OS14B	338.0	0.00	+∞	392.2	0.00	+∞
OS568B	1268.4	527.1	3710.6	1314.9	341.8	3620.1
OS79B	814.0	72.7	3256.2	814.0	0.00	3119.3
OA456C	714.0	0.00	3156.1	714.0	0.00	3019.2
OA7C	262.2	0.00	2704.4	262.2	0.00	2567.5
OA123C	154.7	0.00	2596.9	154.7	0.00	2460.0
OMC	543.3	0.00	2985.5	547.5	0.00	2852.7
OS14C	18.8	0.00	2461.0	17.3	0.00	2322.6
OS79C	669.2	0.00	3111.3	669.2	0.00	2974.4
OS568C	690.9	0.00	3133.0	688.4	0.00	2993.7
OS14W	3183.5	2442.1	+∞	3278.4	2305.3	+∞
OS568W	3853.8	3112.5	6295.9	3943.9	2970.9	6249.2
OS79W	1883.9	1142.6	4326.1	1883.9	910.9	4189.2
OA456O	125.2	0.00	2567.3	125.2	0.00	2430.4
OA7O	19.4	0.00	2461.5	19.2	0.00	2324.7
OA123O	7.9	0.00	2450.0	7.9	0.00	2313.1
OMO	74.9	0.00	+∞	74.9	0.00	+∞
OS14O	7.2	0.00	+∞	7.2	0.00	+∞
OS568O	40.5	0.00	+∞	40.5	0.00	+∞
OS79O	8.0	0.00	2450.1	8.00	0.00	2313.2
DEMWC	20000	17558	20741.3	20000	17557.9	20973.
DEMTB	+∞	−∞	122.5	+∞	−∞	122.5
DEMMIS	+∞	−∞	5111.3	+∞	−∞	6113.8

TABLE F-5: VARIABLE DEFINITIONS OF RIGHT HAND SIDE RANGES

VARIABLE	DESCRIPTION
OA456W	Alberta 456 - wheat exports.
OA7W	Alberta 7 - wheat exports
OA123W	Alberta 123 - wheat exports
OMW	Manitoba - wheat exports
OA456B	Alberta 456 - barley exports.
OA7B	Alberta 7 - barley exports.
OA123B	Alberta 123 - barley exports.
OMB	Manitoba - barley exports.
OS14B	Saskatchewan 14 - barley exports.
OS568B	Saskatchewan 568 - barley exports.
OS79B	Saskatchewan 79 - barley exports.
OA456C	Alberta 456 - canola exports.
OA7C	Alberta 7 - canola exports.
OA123C	Alberta 123 - canola exports.
OMC	Manitoba - canola exports.
OS14C	Saskatchewan 14 - canola exports.
OS79C	Saskatchewan 79 - canola exports.
OS568C	Saskatchewan 568 - canola exports.
OS14W	Saskatchewan 14 - wheat exports.
OS568W	Saskatchewan 568 - wheat exports.
OS79W	Saskatchewan 79 - wheat exports.
OA456O	Alberta 456 - oats exports.
OA7O	Alberta 7 - oats exports.
OA123O	Alberta 123 - oats exports.
OMO	Manitoba - oats exports.
OS14O	Saskatchewan 14 - oats exports.
OS568O	Saskatchewan 568 - oats exports.
OS79O	Saskatchewan 79 - oats exports.
DEMWC	Total throughput at the West Coast
DEMTB	Total throughput at Thunder Bay.
DEMMIS	Total throughput down the Mississippi River.

Since range analysis only includes changes to one right hand side value at a time, *ceteris paribus*, one would expect these sub-regional export levels to become more sensitive under a simultaneous change in these values and transportation cost coefficients.

D. Parametric Programming

Parametric programing, as stated previously, allows a simultaneous change in many of the parameters at a given time. Therefore, this represents a useful extension of sensitivity analysis, that is, to check the effect of "correlated" parameters that change together due to factors such as weather and prices. This in fact allows you to increase and decrease some activity values and right hand side levels at the expense of other activities and constraint levels.

Objective Function Coefficient Changes

The consequences of a one to 15 percent incremental increase and decrease in Thunder Bay shipping costs are illustrated in Table F-6.

TABLE F-6: OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 12 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 3 PERCENT INCREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	0.13	3.55	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN					
14	-	-	-	-	
568	-	-	-	-	
79	1.46	0.81	-	2.27	
MANITOBA	-	-	-	-	
TOTAL	4.48	4.31	0.15	8.94	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	0.01	0.01	
7	-	-	-	-	
SASKATCHEWAN					
14	3.18	0.84	-	3.52	
568	3.85	1.27	-	5.12	
79	0.42	-	-	0.42	
MANITOBA	3.14	0.89	-	4.03	
TOTAL	10.50	2.50	-	13.00	
EAST COAST					
ALBERTA					
123	-	-	0.01	0.01	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	0.01	0.01	
568	-	-	0.04	0.04	
79	-	-	0.01	0.01	
MANITOBA	-	-	0.08	0.08	
TOTAL	-	-	0.13	0.13	909,199

...Continued

TABLE F-6: *Con't* **OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 12 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)**

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 7 PERCENT INCREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	0.01	2.15	
456	1.30	2.12	0.13	3.55	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN					
14	-	-	-	-	
568	-	-	-	-	
79	1.46	0.81	-	2.27	
MANITOBA	-	-	-	-	
TOTAL	4.48	4.31	0.16	8.94	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	0.01	0.01	
568	3.85	1.27	-	5.12	
79	0.43	-	-	0.43	
MANITOBA	3.14	0.89	-	4.03	
TOTAL	10.60	2.50	0.01	13.10	
EAST COAST					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	0.01	0.01	
568	-	-	0.04	0.04	
79	-	-	0.01	0.01	
MANITOBA	-	-	0.08	0.08	
TOTAL	-	-	0.14	0.14	990,422

...Continued

TABLE F-6: ***Con't*** **OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 12 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)**

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 3 PERCENT DECREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	-	3.42	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN				-	
14	-	-	-	-	
568	-	-	-	-	
79	1.59	0.81	-	2.40	
MANITOBA	-	-	-	-	
TOTAL	4.61	4.31	0.02	8.94	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	0.34	-	0.34	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	-	0.89	-	0.89	
TOTAL	-	1.23	-	1.23	
EAST COAST					
ALBERTA					
123	-	-	0.01	0.01	
456	-	-	0.13	0.13	
7	-	-	-	-	
SASKATCHEWAN					
14	3.18	-	0.01	3.19	
568	3.85	1.27	0.04	5.16	
79	0.29	-	0.01	0.30	
MANITOBA	3.14	-	0.08	3.21	
TOTAL	10.50	1.27	0.26	11.90	960,021

...*Continued*

TABLE F-6: *Con't* **OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 12 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)**

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 14 PERCENT DECREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	-	3.42	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN				-	
14	-	-	-	-	
568	-	-	-	-	
79	1.59	0.81	-	2.40	
MANITOBA	-	-	-	-	
TOTAL	4.61	4.31	0.02	8.94	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	-	-	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	-	0.89	-	0.89	
TOTAL	-	0.89	-	0.89	
EAST COAST					
ALBERTA					
123	-	-	0.01	0.01	
456	-	-	0.13	0.13	
7	-	-	-	-	
SASKATCHEWAN					
14	3.18	0.34	0.01	3.53	
568	3.85	1.27	0.04	5.16	
79	0.29	-	0.01	0.30	
MANITOBA	3.14	-	0.08	3.21	
TOTAL	10.50	1.61	0.26	12.30	919,293

...Continued

TABLE F-6: *Con't* **OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 12 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)**

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 15 PERCENT DECREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	-	3.42	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN				-	
14	-	-	0.01	0.01	
568	-	-	0.04	0.04	
79	1.59	0.81	-	2.40	
MANITOBA	-	-	-	-	
TOTAL	4.61	4.31	0.07	8.99	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	-	-	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	-	-	0.01	3.15	
TOTAL	-	-	0.01	3.15	
EAST COAST					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	3.18	0.34	-	3.53	
568	3.85	1.27	-	5.16	
79	0.29	-	0.01	0.30	
MANITOBA	3.14	0.89	0.08	4.10	
TOTAL	10.50	1.27	0.26	11.90	912,651

...Continued

TABLE F-7: OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 20 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 7 PERCENT INCREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	0.13	3.55	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN				-	
14	2.40	-	-	2.40	
568	3.85	1.27	0.04	5.16	
79	1.88	0.81	0.01	2.27	
MANITOBA	-	-	-	-	
TOTAL	11.15	5.58	0.20	16.50	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	0.78	0.34	-	1.12	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	3.14	0.89	-	4.03	
TOTAL	3.92	1.23	-	5.15	
EAST COAST					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	0.01	0.01	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	-	-	0.08	0.08	
TOTAL	-	-	0.09	0.09	839,970

TABLE F-7: *Con't* **OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 20 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)**

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 3 PERCENT DECREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	0.13	3.55	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN				-	
14	2.44	-	-	2.44	
568	3.85	1.27	-	5.12	
79	1.88	0.81	0.01	2.70	
MANITOBA	-	-	-	-	
TOTAL	11.19	5.58	0.16	16.93	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	0.34	-	0.34	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	-	0.89	-	0.89	
TOTAL	-	1.23	-	1.23	
EAST COAST					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	0.74	-	0.01	0.75	
568	-	-	0.04	0.04	
79	-	-	-	-	
MANITOBA	3.14	-	0.08	3.22	
TOTAL	3.88	-	0.22	4.01	838,708

...Continued

TABLE F-7: *Con't* **OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS AND A 20 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)**

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 14 PERCENT DECREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	0.13	3.55	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN				-	
14	2.44	-	-	2.44	
568	3.85	1.27	-	5.12	
79	1.88	0.81	0.01	2.70	
MANITOBA	-	-	-	-	
TOTAL	11.19	5.58	0.16	16.93	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	-	-	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	-	0.89	-	0.89	
TOTAL	-	0.89	-	0.89	
EAST COAST					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	0.74	0.34	0.01	1.09	
568	-	-	0.04	0.04	
79	-	-	-	-	
MANITOBA	3.14	-	0.08	3.22	
TOTAL	3.88	0.34	0.13	4.35	838,708

...Continued

Shown here are only the results of a change in the optimal basis given an increase/decrease in these logistic costs. Grain trade flows to the three export ports are only affected at a 3 and 7 percent cost increase and a 3, 14, and 15 percent decline, under Thunder Bay/Vancouver/Mississippi pricing and a

TABLE F-7: ***Con't*** **OPTIMAL GRAIN SHIPPING PATTERNS GIVEN POST OPTIMAL ANALYSIS (CHANGES IN THUNDER BAY SHIPPING COSTS) AND A 20 MILLION TONNNE WEST COAST CONSTRAINT (1985-1986)**

Millions of Tonnes

REGION	WHEAT	BARLEY	OATS	TOTAL	TOTAL COSTS ('000 $)
THUNDER BAY/VANCOUVER/MISSISSIPPI PRICING AND A 15 PERCENT DECREASE IN THUNDER BAY SHIPPING COSTS					
WEST COAST					
ALBERTA					
123	1.38	0.77	-	2.15	
456	1.30	2.12	0.13	3.55	
7	0.34	0.61	0.02	0.97	
SASKATCHEWAN				-	
14	2.44	-	-	2.44	
568	3.85	1.27	-	5.12	
79	1.88	0.81	0.01	2.70	
MANITOBA	-	-	-	-	
TOTAL	11.19	5.58	0.16	16.93	
MISSISSIPPI					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	-	-	-	-	
568	-	-	-	-	
79	-	-	-	-	
MANITOBA	-	-	-	-	
TOTAL	-	-	-	-	
EAST COAST					
ALBERTA					
123	-	-	-	-	
456	-	-	-	-	
7	-	-	-	-	
SASKATCHEWAN					
14	0.74	0.34	0.01	1.09	
568	-	-	0.04	0.04	
79	-	-	-	-	
MANITOBA	-	0.89	0.08	0.97	
TOTAL	0.74	1.23	0.13	2.10	815,301

12 million tonne constraint at West Coast ports.[41] Comparing the initial transportation patterns in Table VIII.2 to the three percent increase in Thunder Bay shipping costs, shows Oats located in Alberta's sub-region 456 being diverted away from Thunder Bay to West Coast ports. Also, exports

---

[41] An additional solution was obtained under St. Lawrence/Vancouver/ Mississippi pricing and a 12 million tonne export constraint at West Coast ports, the results were similar to those under Thunder Bay/Vancouver/ Mississippi pricing. Any differences in the two solutions resulted from a change in applicable quantities available for export.

of oats from sub-region 123 in Alberta under a seven percent increase in freight costs results in shipments through Vancouver and/or Prince Rupert ports instead of through Thunder Bay. When shipping costs are decreased by three percent through Thunder Bay ports, wheat exports located in all of Saskatchewan's sub-regions and in Manitoba are found to be efficiently shipped to Thunder Bay and West Coast ports, thereby, reducing Mississippi shipments from these provinces. Barley exports in Saskatchewan's sub-region 568 would also be diverted away from Mississippi ports to Thunder Bay ports given a three percent decline in Thunder Bay shipping costs. It was found by declining transportation costs through Thunder Bay by 14 and 15 percent results in barley exports from sub-region 14 in Saskatchewan and in Manitoba being more cost efficient shipped through the St. Lawrence Seaway via Thunder Bay.

Overall, total system grain transportation costs would vary from a low of 912 million dollars (15 percent decline in freight costs) to a high of 990 million dollars (3 and 6 percent increases in freight costs). In summary, changes in grain flows in western Canada are quite insensitive to Thunder Bay freight costs changes, under a 12 million tonne West Coast capacity restriction and St. Lawrence or Thunder Bay/Vancouver/Mississippi pricing. The result is that export prices would have to change substantially in the short run causing Thunder Bay to be the more lucrative position for western Canadian grain.

In comparison, with Thunder Bay/Vancouver/Mississippi pricing and under a 20 million tonne West Coast shipment constraint, grain shipment patterns are more insensitive to cost increases at Thunder Bay than under a 12 million tonne West Coast restriction (Table F-7).

Although under both constraint levels, declines in shipping costs through Thunder Bay generates similar changes in the direction of grain shipment patterns in western Canada. Given the seven percent increase in Thunder Bay shipping costs, under a 20 million tonne Vancouver and/or Prince Rupert restriction, results in oats from sub-region 568 in Saskatchewan being diverted away from Thunder Bay to West Coast ports. Also, under a 14 and 15 percent decline in these logistic costs at Thunder Bay shows Thunder Bay and West Coast ports being the only two positions where grain would be shipped more cost efficient for prairie grain producers. Therefore, the Mississippi River would not be a viable grain export route given large declines in Thunder Bay shipping costs under a 20 million tonne West Coast constraint.

An additional run to analyze the effects of a simultaneous change in transportation costs down the Mississippi River, under a 12 and 20 million tonne West Coast constraint and Thunder Bay/Vancouver/Mississippi pricing was examined.[42]

These changes occur between one and 20 percent. With increasing shipment costs of 3, 16, and 17 percent down the Mississippi River, grain shipments are diverted away from the Mississippi system to Thunder Bay ports for Saskatchewan and Manitoba primary producers under both a 12 and 20 million tonne Vancouver and/or Prince Rupert export restriction. Further, at a 17 percent increase in these Mississippi logistic costs, results in the Mississippi River being a non viable export route for western Canadian grain under both West Coast constraint levels. The Mississippi River would be a cost efficient route for western Canadian grain, especially for those producers located in Saskatchewan and Manitoba, if cost increases to use this system remained at a level less than 17 percent.

It was estimated that when Mississippi shipping costs are decreased substantially (18 percent), that no grain shipments through Thunder Bay ports would exist under both a 12 and 20 million tonne export constraint at West Coast ports. Therefore, Thunder Bay ports would be a viable export route in the short run given small decreases in Mississippi grain shipping costs.

Changes to Right Hand Side Values

A simultaneous change in all sub-regional wheat and barley exports was also used to test the sensitivity of the grain re-distribution model. These export levels were tested under four different price scenarios, thereby, reflecting the range in production adjustments estimated in section B. These scenarios consisted of the following:

H-1 A one percent decline in barley and a 4 percent increase in wheat exports.

H-2 A 2 percent decline in barley exports while applicable quantities of wheat are increased by 8 percent.

H-3 A 6 percent decline in barley exports and a 12 percent increase in wheat exports.

H-4 A 9 percent decline in barley exports and a 15 percent increase in sub-regional wheat exports.

---

[42] Incremental changes to objective function coefficients associated with grain shipments down the Mississippi River under St. Lawrence/Vancouver/Mississippi pricing and a 12 million tonne West Coast restriction results in the objective function coefficients being affected at the same magnitude. Therefore, the difference between Thunder Bay/Vancouver/Mississippi and St. Lawrence/Vancouver/Mississippi pricing occurs because of changes in quantities available for export.

It was found that under each scenario the optimal allocation of grain exports to the three ports are identical to the initial shipment patterns estimated (Table VIII.2). Therefore, the production adjustments discussed previously because of policy changes would have no impact on optimal grain shipment patterns under the Mississippi River alternative and a 12 million tonne West Coast constraint.

Changes in Mississippi River and Thunder Bay shipping costs were examined also under each of the above price scenarios. The results indicate that shipment patterns would not vary to those findings under both Mississippi and Thunder Bay cost changes, *ceteris paribus*.